

Rock Products

With which is
Incorporated

CEMENT and ENGINEERING
NEWS

Founded
1896

Volume XXXV

Chicago, March 12, 1932

Number 5

Water Transportation a Vital Factor in Rock Products Industry



The Illinois waterway program may radically alter the transportation map of Illinois. This busy river scene is near Mapleton, Illinois. The barges are loaded with sand and gravel

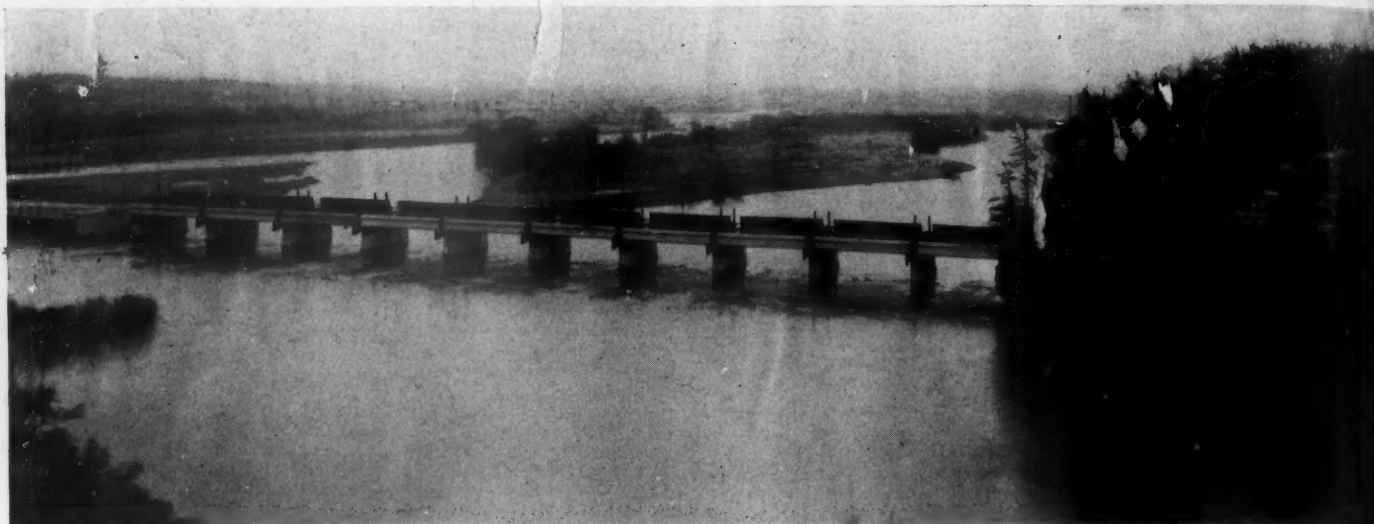
THE EDITORS have frequently referred in these pages to the importance to producers of keeping pace with changing economic conditions. The changes already wrought in the rock products industry by developments in bulk transportation of cement, stone and gravel on the Great Lakes have been described. Similar changes, on a smaller scale, are taking place elsewhere.

For example it is promised that this year will see the completion of the Chicago Drainage Canal-Illinois River project which will provide an adequate inland waterway from Chicago to the Gulf of Mexico. The railway managements seem to appreciate the significance of this undertaking, but do producers of rock products? Already water-borne sand and gravel from Lockport to

Chicago is an important factor in the metropolitan market. Water-borne cement from La Salle to points down the river is a factor, although not yet an important one. Silica from the Ottawa, Ill., district, water-borne from points near the Illinois river both to Great Lakes and Mississippi valley points may become a very important factor. Do rock products producers and manufacturers yet visualize the possibilities of cheap water transportation?

In the La Salle, Ill., district, adjacent to the new Illinois waterway, are three cement companies, all using the dry process. The plants all have relatively the same operating problems. Stripping is for instance a high cost item in all the plants as the amount of stripping done will run from 10 to 45 ft. to

get at 20 to 24 ft. of limestone. One company augments its quarry output from a drift mine, but as the mine's output is small compared to the total requirements the actual cost advantage of the entire mine and quarry operation over that of a neighboring competitor is probably questionable. Fuel, electric power and labor costs may vary slightly between plants, but the size of these variations is also questionable, and in no measure accounts for differences in price quotations such as were recently reported to have been made to buyers. There is one outstanding difference in the three plants, or rather, four, for there is one at Dixon, Ill., which can be included in the La Salle district. This outstanding difference is capacity; one plant has a capacity in the neigh-



One of the diversion dams used for diverting water through locks on the Illinois river

borhood of 10,000 bbl. per day, and the other three will approach 4500 bbl. per day each.

The company with the largest capacity is reported to have consistently made the lowest quotations. Yet, this company is the one which has done the largest amount of improvement and development work; is the only one to grasp immediately the opportunity to make bulk water shipments. Without discussing prices or methods employed, the fact remains that one producer of the three is paving the way to distribute his product by the cheapest and most economical method of transportation for bulk commodities known to engineering. Whether excessively low delivered prices quoted are justified or not one producer is equipping himself to distribute his product at less cost than his competitors. With two plants, one on the Mississippi river below St. Louis, and one on the Illinois river above St. Louis, with a good part of the richest section of the Mississippi valley in between, this company has already demonstrated that it occupies a strategic position in the Mid-West cement market.

How many of the State of Illinois' 1932 highway building projects could be served by this waterway system we do not know, but they must be considerable, as some 78% of the area and 86% of the population are within trucking distance of navigable waters. And when one considers the possibilities of shipments of cement in bulk to concrete mixing plants and packing plants both on shore and afloat, it can be guessed that extensive use of these connecting waterways may cause revolutionary changes in the present set-up of the cement and aggregate industries in the Mississippi valley states. Who can say?

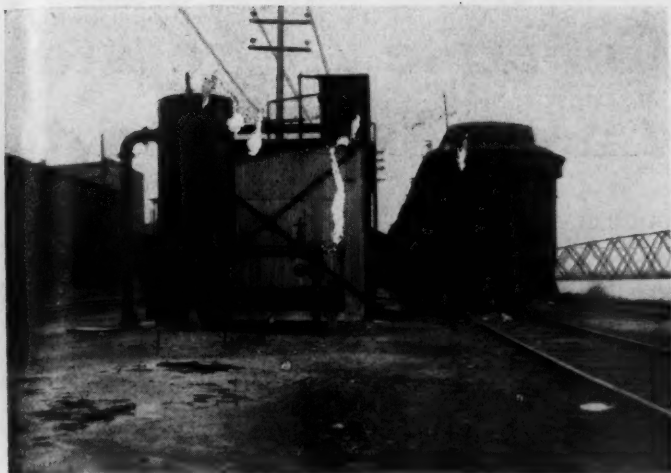
In addition to cement and aggregates that will be used in connection with the state's highway work during 1932 there is some considerable tonnage of both construction materials in the offing in connection with the development of the Illinois river waterway itself. This program calls for the comple-

tion of some ten locks. In addition to the lock construction some 85 bridges will have to be dismantled and in most cases will be replaced by new structures. Present bridges across the Illinois river that do not have proper vertical and horizontal clearances will have to be removed or made to comply with the requirements. The cost of rebuilding the bridges it is said must be borne by the present owners of the bridges be they state, county or railroad. Relocation of concrete footings and piers for such work should help the cement and aggregate producers in the district.

Once the river is developed the transportation of cement and other rock products from the central portion of Illinois into the west sections of Chicago may be altered materially and may call for added equipment for water transportation of bulk cement and other rock commodities. The practice of transporting bulk cement and packing at or near destination as done in other districts may be duplicated here. At



In Illinois 78% of the area is within trucking distance of navigable rivers



Air compressor building and receivers used for loading bulk cement to river barges at Peru, Ill.



The loading facilities are not complicated or elaborate. The barges are moored along shore and loaded by pipe lines

present one company in the La Salle district is making small bulk water shipments to points below La Salle. For this purpose the cement is hauled from its plant on the Vermilion river in box cars to Peru, Ill., where pneumatic unloaders or pumps deliver the cement to river barges. Incidentally the company doing this work is the farthest of the three from the Illinois river. The remaining two producers could, no doubt, pump direct from the silos at the mill to barges. This is readily possible for one producer whose plant is directly on the banks of the Illinois river.

makes all its shipments by barges on the Illinois river and is probably the first aggregate producer to take full advantage of the new waterway.

Those who live in the state of Illinois may be too prone to sit idly by and watch the river development as a matter of course, only to wake up and find some promoter busy in our midst, using this new waterway development as the lure to charm new investors into an already over-saturated field. The easiest and best way to circumvent such promotional schemes is for producers already established to strike first and take full

Principles of Patent Law

THE Chemical Catalog Co., New York, N. Y., has published "Principles of Patent Law for the Chemical and Metallurgical Industries." This book, by Anthony William Deller, gives information on patent law in the chemical and metallurgical industries and explains complex legal doctrines of patent law in terms of chemistry and metallurgy. The author is a member of the New York bar, a member of the patent bar, and a chemical engineer as well.

Canada's Nonmetallic Mineral Products in November

THE Dominion Bureau of Statistics at Ottawa has issued the following information on the production of some nonmetallic minerals in November, 1931.

PRODUCTION OF NONMETALLIC MINERALS IN CANADA

		1931—November—1930
Asbestos	tons	14,068 18,344
Cement	bbl.	792,535 713,643
Coal	tons	1,263,087 1,349,694
Feldspar	tons	1,207 2,150
Gypsum	tons	50,135 78,424
Lime	tons	29,628 40,257
Salt	tons	17,803 (*) 22,035

*Includes commercial salt and the salt content of brine used for chemical purposes. Data for 1931 include only the commercial salt produced.

Abrasives*

A TABULATION of abrasives sold or used by producers in the United States, 1926 to 1930, inclusive, is given below.

Year	Emery		Garnet		Crude and finished tripoli (as sold)		Pumice and pumicite		Grinding pebbles and tube mill lining	
	Shrt. tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1926	506	\$5,855	6,397	\$523,875	31,369	\$523,609	53,887	\$208,504	6,219	\$85,146
1927	1,341	16,787	6,939	573,525	26,099	447,068	53,298	221,481	3,342	46,856
1928	924	10,722	6,617	459,307	34,043	555,576	57,430	278,516	6,288	89,321
1929	924	10,722	5,961	435,420	38,011	545,658	60,873	318,579	4,630	66,178
1930	555	5,996	5,003	314,129	32,439	507,505	56,843	336,099	3,480	50,816

*United States Bureau of Mines Reports.



Arrangements for loading barges with gravel at plant of Cast Stone Construction Co. at Mapleton, Ill., on the Gulf to Great Lakes waterway

Obviously, as already suggested, the advantage of river transportation offered by the new waterway is not only a factor for the cement industry to reckon with but may be one for aggregate producers. For several years a sand and gravel producer at Lockport, Ill., has been making water shipments eastward via the canal into Chicago territory. Last year a new sand and gravel plant was constructed at Mapleton, Ill., a short distance below Peoria, Ill. This new producer, the Cast Stone Construction Co.,

advantage of any opening or reduction in transportation costs that the new navigation possibilities offer.

Recent Research on Concrete Aggregates by the Portland Cement Association

By H. F. Gonnerman*

IN ROCK PRODUCTS for January 17, 1931, the writer presented a resumé of the principal research activities of the Portland Cement Association for 1930. Most of the projects which were described in considerable detail in that resumé were continued during 1931 and new investigations on cement and concrete were inaugurated. Since many of these investigations are not of general interest, it is intended in this article to deal only with current researches concerned with concrete aggregates and aggregate testing.

Fire Tests of Concrete Masonry Walls

Studies of the influence of the type and grading of aggregate formed an important part of this comprehensive investigation of the fire endurance and load-carrying ability of walls of concrete masonry units when subjected to standard fire test conditions. Tests of over 200 concrete masonry panels 5½ ft. wide and 6 ft. high have established the underlying principles governing fire resistance and load-carrying properties.

The test equipment, methods of conducting the tests and some of the more significant results are described fully in the paper by C. A. Menzel published in the 1931 Proceedings of the A. S. T. M. The general design and scheme of operation of the test furnace may be seen from Fig. 1. The furnace fire is controlled by manually operating the gas valves so that the furnace temperatures follow a standard time-temperature curve. According to this curve the furnace temperature increases rapidly during the first hour to 1700 deg. F. and then more gradually until at the end of 2, 3, and 4 hours temperatures of 1850, 1925, and 2000 deg. F. respectively are obtained. After fire exposure, the test wall can immediately be withdrawn from the furnace and either cooled in freely circulating air, or exposed to a standard water stream applied to the incandescent face.

Basis for Evaluating Performance of Walls. The performance of the walls is compared principally on two bases: (1) Fire endurance period—the period during which the test walls sustain a working load of 80 lb. per sq. in. of gross sectional area under standard fire exposure, without transmission of flame, hot gases, and high temperatures to the unexposed side as defined by the standard fire test specifications; and

(2) strength or load-carrying ability after fire exposure.

Influence of Grading of Aggregate on Fire Endurance and Strength of Wall. Tests with four widely different types of aggregate (calcareous, and siliceous sand and gravel, crushed limestone and Haydite) showed that with a given cement content, the fire endurance period increased as the proportion of fine to coarse aggregate in the concrete mixture was increased in spite of the accompanying variations in the voids, weight and strength of the individual units. In these tests, which covered the entire range of grading possible in the practical manufacture of concrete masonry units by the "tamped" method, the fire endurance period with the finest grading was from 15 to 20% greater than with the coarsest grading. It should be pointed out, however, that the effects of grading upon the fire endurance period were insignificant in comparison with their very

marked effect on the original strength of the units and the strength of the walls both before and after fire exposure. In general, therefore, the proportion of fine to coarse aggregate should be based upon considerations of strength of wall rather than upon fire endurance.

Influence of Type of Aggregate on Fire Endurance Period. Table 1 compares the performance of a series of 10 8-in. walls constructed of units of standard 3-oval-core

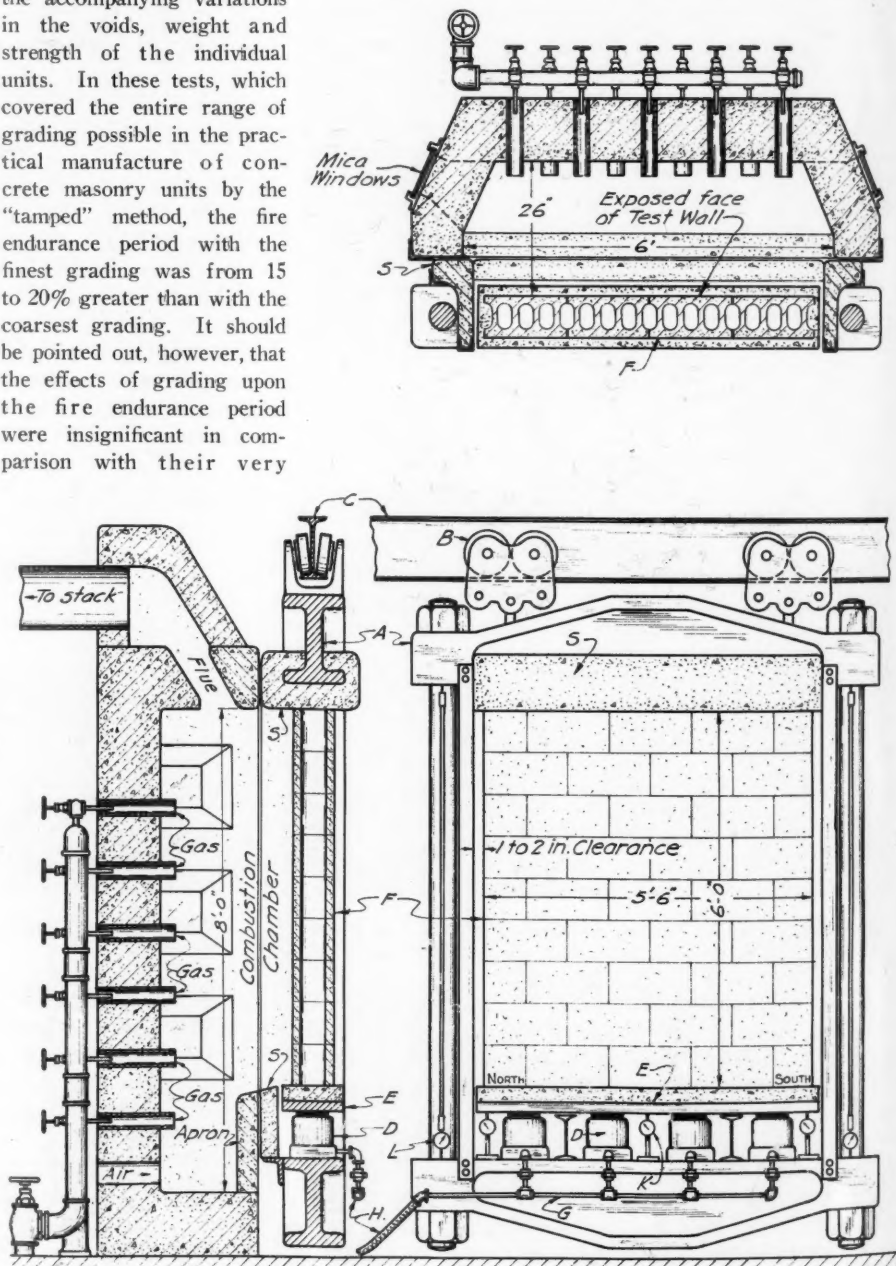


Fig. 1. General arrangement of test furnace and movable test frame

*Manager, Research Laboratory, Portland Cement Association, Chicago.

TABLE I. FIRE ENDURANCE OF 8-IN. CONCRETE MASONRY WALLS AS AFFECTED BY CHARACTER OF AGGREGATE

Type	Aggregate		Unit weight, lb. per cu. ft.*	Mix by volume	Cement content		Average air-dry weight, lb.		Fire endurance period, min. per lb. per sq. ft. of wall
	Fineness modulus				Blocks per sack	Lb. per block	Per block	Per sq. ft. of wall	
Coke breeze	3.50	49	1:7.5	21.2	4.44	23.5	29.0	110	3.79
Siliceous gravel A	3.50	115	1:7.5	21.8	4.30	45.2	53.2	124	2.33
Siliceous gravel B	3.70	113	1:8.3	22.5	4.18	46.7	54.9	129	2.35
Crushed fire brick	3.50	91	1:7.5	21.9	4.29	36.8	43.8	145	3.21
Calcareous gravel	3.50	120	1:7.8	22.4	4.20	46.6	54.8	150	2.74
Crushed limestone	3.50	120	1:7.8	21.7	4.33	49.0	57.4	158	2.75
Soft coal cinders	3.25	79	1:7.0	20.6	4.56	33.9	40.6	163	4.01
Haydite	3.50	67	1:7.0	21.2	4.43	27.6	33.5	168	5.01
Crushed common brick	3.50	77	1:7.5	21.6	4.36	32.3	38.8	175	4.51
Air-cooled slag	3.50	102	1:7.5	22.0	4.25	41.1	48.7	193	3.96
Average									152

*Based on dry rodded 0 to $\frac{3}{8}$ -in. aggregate graded to fineness modulus indicated.

design which differed principally in the type of aggregate employed and to a lesser extent in the grading of aggregate and cement content.

It will be observed that with the grading of aggregates and cement content of units constant, the fire endurance period of the 10 walls ranged from 27% below to 27% above the average period of 152 minutes for the group. When compared on the basis of fire endurance in minutes per pound of material per square foot of wall the four aggregates showing the highest fire endurance periods were nearly twice as effective as the two aggregates showing the lowest fire endurance period.

While in Table 1 the different aggregates are tabulated in order of increasing fire endurance periods of 8-in. walls, other tests have shown that the relative position of the various aggregates is altered somewhat when compared on the basis of the fire endurance periods obtained with 4-in. and 12-in. walls. This is due to differences in the thermal conductivity of different types of concrete as various fire effects, are brought into play when walls differing in thickness are exposed to fire of different intensities (1 to 8 hours).

Attention is called to the fact that although different results were obtained with different types of aggregate, tests of the other factors studied showed that by the proper selection of type of unit, cement content, grading of aggregate, wall thickness, etc., any particular requirements can be met with any of the aggregates tested.

Influence of Type of Aggregate on Wall Strength. One of the outstanding results of this investigation was the repeatedly demonstrated load-carrying ability and safety of the walls, before, during and after severe fire exposure. It was found that for a given type of aggregate, the compressive strength of the walls, both when tested without exposure to fire and after exposure to fire, was approximately proportional to the original compressive strength of the units even though the design of unit, grading of aggregate and cement content varied over a wide range. The establishment of this relationship was one of the most useful and important developments of the strength tests and provided a means of comparing units made

from the several types of aggregates as to their load-carrying ability in 8-in. walls. In general 700-lb. units made from the various aggregates produced walls having strengths after severe fire exposure of from 2 to 3 times the specified working load of 80 lb. per sq. in. of gross area.

Spalling of Concrete. In no case was there any evidence of spalling of the concrete. This is interesting, considering the great range in type and grading of aggregate, cement content, strength and denseness of the concrete and design of units (thin, medium and thick face shells). An occasional local spalling or pitting of aggregate particles at the exposed face of the walls was found in the case of two of the aggregates, Haydite and air-cooled blast-furnace slag, but these local effects were of no consequence as they did not appear to affect in any way the load-carrying ability or fire endurance of the walls.

The data from this investigation provide basic information for the manufacture of concrete masonry units, from a wide range of aggregates, which will produce walls meeting any requirements as to fire endurance and strength.

Studies of Workability of Concrete

Studies of the relative economy of various aggregate gradations and of the performance of admixtures, have long been handicapped by the lack of an acceptable means of measuring the workability of concrete mixtures. During the past year our Laboratory has developed an apparatus and method of test which has made it possible to secure new and significant information on the workability of concrete mixtures. Although this new test does not completely measure workability it does differentiate sharply between mixtures having the same slump or flow. Moreover when mixtures which appear identical when measured by slump or flow are compared by the new test, it is found that the differences exhibited are always in the direction which judgment and experience would indicate.

This test, which has been termed the "remolding test," measures the relative effort required to change a mass of concrete from one definite shape to another by means of jiggling. The number of jigs required to effect this remolding is termed the "remolding effort." Fig. 2 shows a cross-section of the apparatus and Fig. 3 illustrates the steps followed in making a test. With the

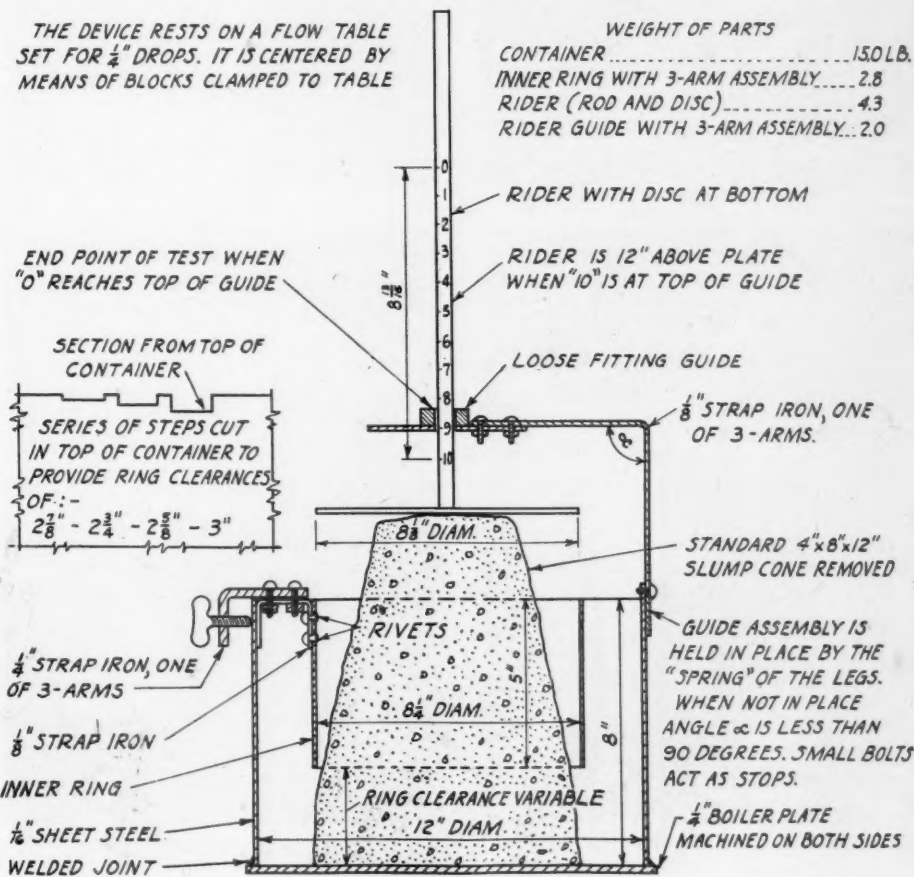


Fig. 2. Cross-section of apparatus used for "remolding test" to indicate workability

aid of this method, considerable progress has been made in studies of the effect of aggregate gradation and of admixtures on the relative economy and workability of concrete mixtures.

Studies of Influence of Sand Content and Gradation. One of the three factors involved in the workability of concrete is the characteristics of the aggregates, that is, their type, size and gradation. In studying aggregate gradation arbitrary proportions of fine to coarse were not, in general, used but different gradings of coarse aggregate were compared with each other when combined with that proportion of sand best suited to the particular gradation and richness of mix used. Furthermore, except in a few instances, fixed mixes were purposely avoided, each aggregate combination being mixed with such quantities of cement paste of fixed water-cement ratio as would produce the consistencies desired. This procedure en-

abled the workability of mixtures to be studied on the basis of a fixed quality of paste (cement plus water).

Although the investigation is in no sense completed, the tests thus far made have shown that for given materials, water-cement ratio and remolding effort, there is, from the standpoint of cement requirements, a definite "optimum" percentage of sand for each gradation of coarse aggregate. This optimum percentage is largely dependent upon the water content of the paste and the degree of mobility required. While the optimum percentage of sand was often close to that producing maximum density in the combined aggregate, it was not found that maximum density was a proper criterion by which to determine the best proportion of sand in a concrete mixture.

Effect of Gradation of Coarse Aggregate. In one series of tests Elgin sand was used in combination with Elgin gravel coarse ag-

gregate which was separated into three sizes (No. 4 to $\frac{3}{8}$ -in., $\frac{3}{8}$ - to $\frac{1}{2}$ -in. and $\frac{1}{2}$ - to 1 $\frac{1}{2}$ -in.) and then recombined so as to cover all possible combinations of the three sizes. This group of tests showed that by properly adjusting the proportions of sand, a wide variety of coarse aggregate gradations could be used with little or no effect on the cement requirement. In many of the combinations tried this was true even when the amount of No. 4 to $\frac{3}{8}$ -in. size (pea gravel) was changed from 0-50% of the total coarse aggregate. On the other hand when an arbitrary proportion of sand to coarse aggregate was used, the proportion of pea gravel in the mixture had a marked influence on the cement requirement of mixes of equal mobility; the cement requirement in this case appeared to depend almost entirely on the percentage of pea gravel in the mixture.

Studies of "gap gradings," and "sized" material in this series showed that when the optimum percentage of sand is used, economical mixtures can be produced without wasting any particular size of material; also that it is feasible to use fewer sizes as a means of minimizing segregation of aggregate when intermediate sizes can be omitted. These results show the possibilities that are open when concrete mixtures are designed to make the most economical use of the available aggregate materials.

Effect of Type of Aggregate. While tests on effect of aggregate have not been extensive they indicate that for the same remolding effort and water-cement ratio, crushed coarse aggregate requires a considerably higher proportion of sand and more cement than rounded coarse aggregate of the same gradation.

A complete discussion of the scope, methods and results obtained thus far in this investigation is given in a paper by T. C. Powers, entitled "Studies of the Workability of Concrete Mixtures," to be published in the February, 1932, *Journal of the American Concrete Institute*.

Study of Effect of Type of Aggregate on Shrinkage of Concrete

A general study of the expansion and shrinkage of concrete upon exposure to a moist or a drying atmosphere has been in progress for the past five years. From this study it appears that the major factors affecting shrinkage of concrete are the quality and quantity of the cement paste and the amount of water lost from the concrete. During the past year tests were made in order to determine whether the type of aggregate has an important influence on the water lost and on the resulting shrinkage.

These tests included both concrete and mortar mixtures having two consistencies each with a total weight in cement content of from 4 to 14 sacks per cu. yd. Specimens in the form of 5-by-5-by-20-in. beams were used. Tests were made with Elgin sand and gravel and with limestone, granite, trap,



(a) Assembly ready for sample



(b) Slump cone removed



(c) Rider assembly in place



(d) End of test. Rider removed

Fig. 3. Showing the steps followed in making the remolding test

sandstone, and slag coarse aggregates in combination with both rock screenings from the same source as the coarse aggregates and with Elgin sand as fine aggregate. In all cases the coarse aggregates were similarly graded and the grading of the screenings was identical with that of the Elgin sand.

The significant results of this series as applied to different aggregates, based on tests of specimens cured 7 days moist and then for 5¼ months in air in a room maintained at a temperature of 70 deg. F. and at a relative humidity of 50%, may be summarized as follows:

For a given cement and consistency, there was in general little difference in the shrinkage exhibited by the concretes or the mortars made with the various aggregates except in the case of the blast-furnace slag. The shrinkage of concrete and mortar specimens made with slag aggregate ranged from about 0.6 to 0.7 that of corresponding mixtures made with the other types.

Concrete specimens made with natural sand as fine aggregate exhibited in most cases about the same shrinkage as concrete specimens of similar cement content and consistency made with screenings, although the screenings required more water to produce a given consistency.

Mortar mixtures required considerably more water than the concrete mixtures for a given consistency and cement content and showed from 60 to 80% greater shrinkage.

Data from this investigation are discussed in the paper by Prof. W. A. Slater before the International Society for Testing Materials, held at Zurich, Switzerland, in September, 1931, on "Designing Concrete for High Strength, Low Permeability and Low Shrinkage."

Durability Studies of Aggregates and Concrete

One of the most important investigations in which the laboratory is now engaged is the general study of durability of aggregates and concrete. This study was begun in an effort to discover the causes of disintegration of concrete roads in a certain locality which seemed to be distinctly worse than anything observed generally throughout the country. Because of the localized feature of the observed condition, the question of aggregates naturally became of particular interest in this study. The investigation included laboratory tests of many samples of fine and coarse aggregates, extensive examinations of the sources of supply, the examination of structures in which suspected aggregates have been used, and many freezing and thawing tests on samples of concrete and mortar made with the aggregates.

Field Examinations. In these examinations close attention is paid to the conditions in the pit or quarry, both at the old and new working faces, and methods of production observed with particular refer-

ence to sources of contamination and general cleanliness of the product. An instance of how the conditions attending the production of aggregates affects the quality of the road is shown in the case of a certain source of supply where the stripping of the overburden was not done in an adequate manner. In this case there was such an accumulation of loam and clay in the final product that it was impossible to wash the aggregate suitably regardless of the quantity of water used. Concrete roads in which these aggregates were incorporated developed excessive scaling. The correction of this condition removed almost entirely the difficulties experienced in producing durable concrete. Other instances have been noted when the product of quarries was not acceptable because large quantities of non-durable stone occurred in the finished product. The faulty ledges were indicated to the operators and upon their elimination the product passed all specifications.

In general, very definite information regarding weather resistance can be obtained from a field examination of the quarry ledges alone. Often, however, the exposure has not been of sufficient duration to permit definite conclusions. Samples from such sources are carefully selected and sent to the laboratory where they are subjected to rigid examination both alone and in concrete. A condition that is sometimes overlooked is the variation in deposits. This is often such that the product from a particular source which is acceptable at any one time may not be acceptable when tested later. In our field inspection attempt is made to arrive at the correct understanding of the geological formation in order to advise as to the probable extent and uniformity of the source.

Laboratory Examinations and Tests. Samples of fine and coarse aggregate sent to the laboratory are subjected to a series of tests in order to obtain all information possible regarding their probable durability when used in concrete. First they are studied geologically, and a lithological count made and in the case of crushed stones they are related to their proper geologic formation in the area from which they originate which is helpful in determining their probable durability.

The petrographic microscope is used to identify the minerals. Knowing the composition of the minerals and their reaction to weathering agents an indication of the sample's durability can be had. Materials such as pyrite, altered feldspar, mica in books, carbon streaks, and clay segregations are revealed by the microscope. Any of these in appreciable amounts are generally considered detrimental to concrete and their presence is looked upon with suspicion. Other features of importance which the microscope reveals are variations in crystal size, textural differences, lack of adherence of individual crystals because of smooth surfaces, type of cementing material and shape of particles.

Tests for cleanliness and deleterious substances are made to determine whether the aggregates are free from coatings and injurious amounts of organic impurities, loam, clay, silt, shale, coal, lignite, mica and soft or rotten particles. Loam is particularly objectionable as it almost always carries organic matter which may impair the strength and durability of concrete and destroy the setting properties of cement. The presence of organic matter is revealed by the colorimetric test. Aggregates showing a high color are examined for lignite, as even small amounts impart a strong color but are not harmful. Excessive amounts of dust, clay and silt have been found to be responsible for lack of durability and wearing resistance of concrete in certain instances. There is a danger that these fine materials will be brought to the surface during finishing operations and form a weak, friable layer of low resistance to weathering.

Sieve analyses are helpful when determining the suitability of fine aggregates, as grading affects workability. Workability is a most important consideration in the production of durable concrete since harsh, undersanded mixtures invite segregation and result in porous concrete which permits attack by disintegrating agencies.

Direct soundness tests by immersion in a saturated sodium sulphate solution are conducted on fine and coarse aggregates according to A. S. T. M. Tentative Methods (C88-31T and C89-31T). Contemporaneously with the sodium sulphate test, samples of aggregate are subjected to alternate freezing and thawing while partially or totally immersed in water.

Mortar and Concrete Tests. Since the final test of the durability of aggregates is their behavior in mortar or concrete, they are made into mortar and concrete specimens which, after periods of moist and air curing, are alternately frozen and thawed. With fine aggregates, 2-in. mortar cubes ranging in mix from rich to lean are used (containing 4½ to 9 gal. of water per sack of cement). Coarse aggregates are made into 6-in. concrete cubes using a range in mixes from rich to lean. Both mortar and concrete cubes are periodically examined during freezing and thawing and their losses in weight determined. Their reduction in strength is compared with the strength of similar unfrozen specimens cured in the moist room.

Resistance of Mortars to Freezing and Thawing. An indication of the type and range of results secured in freezing and thawing tests of 2-in. mortar cubes may be had from Fig. 4 which is based on tests of a calcareous sand (No. 10279) and a shaly-siliceous-calcareous sand (No. 10333). The diagrams in the left-hand portion of the figure show, for each of the four water-cement ratios used, the relation between the percentage loss in weight of the cubes and the number of cycles of freezing and thawing. Those in the right-hand portion show the

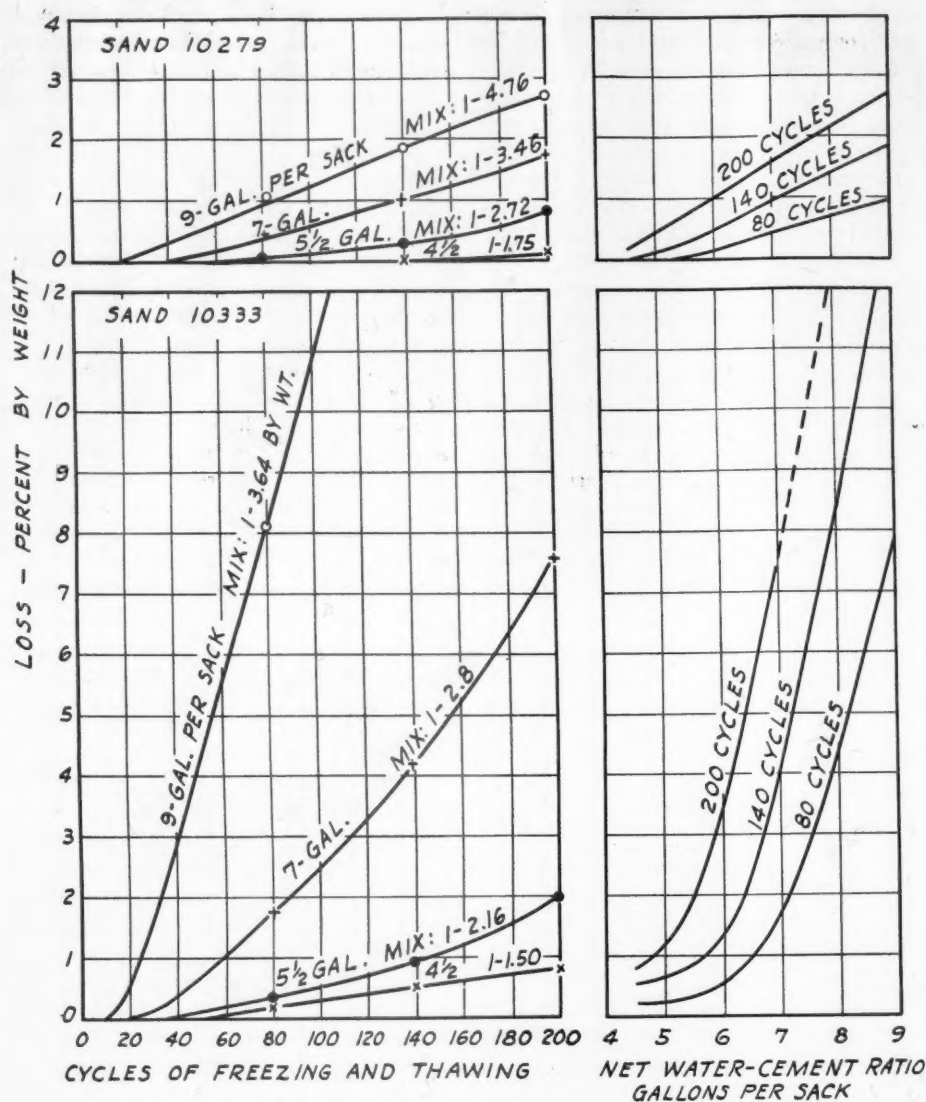


Fig. 4. Results of freezing and thawing tests showing marked influence of water-cement ratio

relation between loss in weight and water-cement ratio at 80, 140 and 200 cycles.

The most significant feature of this figure is the marked influence of the water-cement ratio on the resistance of the cubes to freezing and thawing. Under the conditions of these tests the 9-gal. cubes began to lose weight almost immediately, the loss increasing rapidly with the number of cycles. In the case of the richer cubes the losses are much less, the 5½- and 4½-gal. cubes showing relatively small losses even at 200 cycles.

Sand 10279 was composed of particles which resisted freezing very well when tested alone while sand 10333 contained many particles that were broken down under similar conditions. The effect of this greater resistance of the particles is brought out in Fig. 4. From the curves for the 7-gal. cubes it is seen that sand 10279 in a lean mortar (1:3.46 mix) shows only about ¼ as much loss at 200 cycles as sand 10333 in a richer mortar (1:2.8 mix)—1.75% as compared with 7.5% loss by weight. Similar comparisons can be made for the other curves.

From our present knowledge it is difficult

to fix the amount of non-durable material permissible in an aggregate. This will vary with the type of concrete and degree of exposure. Tests on a number of fine aggregates show that sands containing shale in excess of about 5% do not produce mortars possessing high resistance to repeated freezing and thawing, when the amount of mixing water exceeds 5½ gal. per sack of cement.

Resistance of Concretes to Freezing and Thawing. Coarse aggregates when frozen and thawed in concrete behave in a manner similar to that shown by the fine aggregates in mortars. Fig. 5 shows the condition of a coarse aggregate when made into concrete, using 5½, 7 and 9 gal. of water per sack of cement after 150 cycles of freezing and thawing. The illustration is typical in that the concretes of low water-cement ratios show the greatest resistance. Some aggregates, however, show greater losses and others less, for these same water-cement ratios.

A fairly complete report on these durability studies will be found in a paper on "Durability Studies of Aggregates and Con-

crete," by the writer and G. W. Ward. This paper was published in the 1931 Proceedings, 7th Annual Convention, Association of Highway Officials of the North Atlantic States, and was abstracted in the National Sand and Gravel Association Bulletin, v. 12, p. 13, May, 1931.

In the present state of our knowledge, it is not possible to state how many years service is equivalent to a given number of cycles of freezing and thawing. One of our problems is to discover some means of correlating field behavior and laboratory freezing and thawing. Concrete cores and cubes taken from structures that have withstood many years exposure are being frozen and thawed in order to obtain information on this point.

Effects of Unsound Aggregates. Among the types of material that most frequently cause failure of concrete are those discussed briefly below.

Fig. 6 (b) compares the behavior of chert coarse aggregate with that of a relatively durable aggregate when incorporated in concrete and subjected to freezing and thawing. The pitted surface and generally fractured condition of the 6- by 12-in. cylinders containing chert can be readily seen. Fig. 6 (a) is a photograph of an actual chert popout from a concrete road. The diameter of the popout is about 3 in. and the thickness about 1½ in. In some instances holes almost 12 in. in diameter, caused by this type of aggregate, have been reported.

A very interesting case of the failure of chert aggregate in the freezing and thawing test was recently encountered in these studies. The aggregate deposit under study was a dredged supply that contained a very high percentage of brownish chert. When tested in 6-in. cubes of 5½-gal. water content, the cubes were totally shattered at about 50 cycles, while parallel specimens made with a relatively durable aggregate, as a basis of comparison, remained in excellent condition.

Another type of failure is that produced by argillaceous limestones. In this case the particles absorbed considerable water which upon freezing split the aggregate and the surrounding concrete. Argillaceous sandstones, particularly when thinly bedded, behave in a similar manner. Soft aggregates such as ochre and rotted granites are the cause of local holes that become a source of trouble when filled with water. Clay—ironstones, shales and similar rocks generally cause popouts when near the surface or shatter the concrete in a relatively few cycles of freezing and thawing.

Aggregates of low absorption such as lints, some cherts, and quartz in over-wet mixes may allow rising water, during the placing of the concrete, to collect around but generally underneath the particle. As the aggregate does not absorb this water, poor bond and a zone of weakness develops so that the aggregate after a few cycles of freezing and thawing loosens and pulls out.

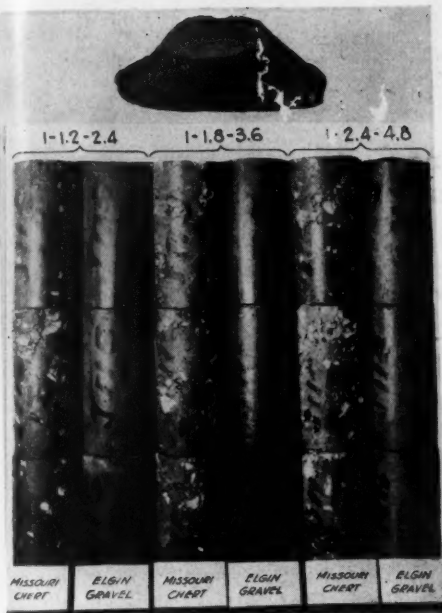


Fig. 6. Above (a), chert popout from concrete road. Below (b), 6- by 12-in. concrete cylinder after 25 cycles of freezing and thawing

Frequently a hammer blow on the concrete reveals this generally loosened characteristic condition.

Defects similar to those described have been observed in the field. F. V. Reagel of the Missouri Highway Commission in a report on "Surface Pit Survey on Concrete Pavements" in Research Abstracts of the National Research Council for October, 1931, points out that the number of surface pits in a concrete pavement made with aggregate containing only 4.3% by weight of chert increased in five years from 493 to 3851 and the area affected increased from about 17 to 107 sq. yd. per mile of concrete.

An argillaceous limestone from a new quarry in one of the eastern states was used to construct a highway and less than five years later replacements were necessary. A similar limestone has shown unsatisfactory performance in certain structures in a mid-western state.

That some sands are harmful is illustrated by the results obtained with an unwashed sand containing a high proportion of shale in a boulevard system in an eastern city. Two years after placing, the structure was badly affected by failure of the sand.

Summary. While these laboratory and field studies of the durability of concrete are only well started, they have clearly indicated that the factor which has the greatest influence in the production of durable con-

crete is the quality of the cement-water paste. Improving the paste by lowering the quantity of mixing water definitely results in greater resistance to weathering.

The characteristics of the aggregate have also been shown to be important. Non-durable particles are broken down under severe exposures and unless protected by a paste of high quality disintegration will result. Certain readily weatherable shales, argillaceous limestones and some cherts should not be permitted except in small amounts for with these materials in large percentages even the highest quality paste will not wholly prevent disintegration. Soundness tests made directly on the aggregate serve in a measure to indicate the possibilities of the material but have not yet been developed to the point where they definitely measure its ability to produce durable concrete.

Aggregate producers can aid materially in the attainment of durable concrete structures by following a regular system of testing, and by exercising care in stripping, in the selection of quarry or pit materials, and in the preparation of their product.

Gravel as a Trickling Filter Medium

BULLETIN No. 40 of the Texas Engineering Experiment Station, College Station, Tex., describes a comparative test with crushed stone and gravel for trickling filter mediums. The stone was a rather soft, light colored limestone. The gravel was 1½-2 in. in size and was supplied by the Texas Sand and Gravel Association. A bed 15x15 ft. and 5 ft. deep was built and divided by a vertical partition, with limestone on one side and gravel on the other. One Taylor spray nozzle with 7.5 ft. radius supplied the raw sewage. A regular plant filter in use for some time received the same raw sewage and the effluents of all three are compared.

There were very few differences in effluents. The crushed-rock filter effected a slightly greater reduction in bio-chemical oxygen demand, while in nitrification the gravel was slightly better. The unloading characteristics of the two were the same.

In February a heavy freeze disintegrated some of the experimental limestone but did not harm either the gravel or the crushed rock (also limestone) in the plant filter. Sodium sulphate soundness tests were therefore run on the rock from all three filter beds. The experimental limestone showed some failure after three cycles. The rock from the plant filter withstood ten cycles, but two of the ten stones tested chipped on the 11th and all had failed with the 20th cycle. The gravel stood 20 cycles with no appreciable effect.

The paper concludes that gravel, 1½-in. to 2-in. in size is as effective as crushed stone of the same size for trickling filter mediums.

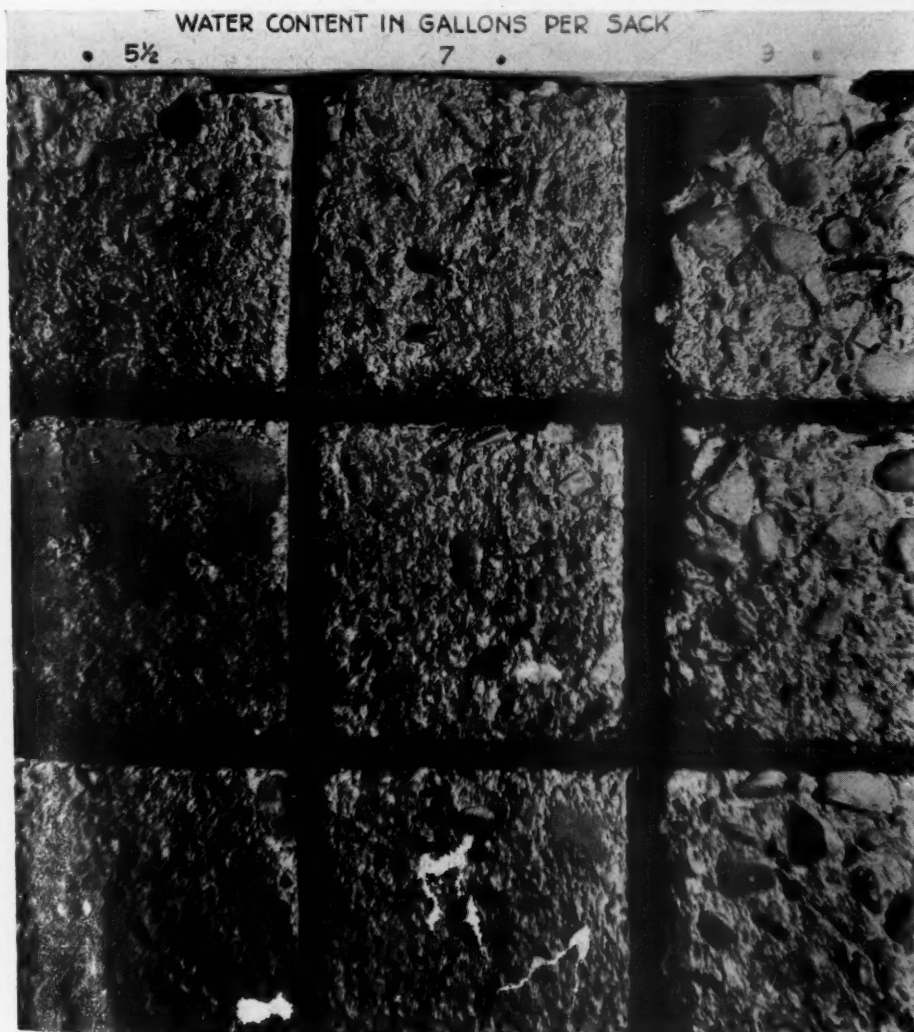


Fig. 5. Concrete cubes after 150 cycles of freezing and thawing

New Cement Burning Process

Method of Burning Cement by Combining a Traveling Grate with a Rotary Kiln, Developed in Europe, and to Be Introduced in America

INCREASED ECONOMY of operation is one of the chief problems at present in the development of the rotary kiln for burning portland cement. While possessing technical and mechanical simplicity, the high fuel consumption renders the rotary kiln far from perfect thermally or economically. For this reason a considerable effort has been made to devise convenient apparatus and arrangements whereby the large amount of heat in the waste gases may be utilized. One popular arrangement has been the installation of waste heat boilers beyond the rotary kilns. Sometimes, however, it is inexpedient to try to combine two such dissimilar processes. The utilization of the heat in the waste gases by means of air heaters is difficult because of the very considerable amount of dust in the gases.

A new and original solution of the problem is an invention of Dr. O. Lellep, which has been described in several publications.* The fundamental idea of this invention is the installation of a traveling grate which is placed in a chamber beyond the rotary kiln. The hot waste gases of the rotary kiln pass through this chamber above the traveling grate which conveys the raw meal in the opposite direction from the feed opening towards the rotary kiln. In order to obtain a most intimate contact between the hot gases and the cold raw meal particles, the gases are sucked through the layer of the raw meal and the traveling grate. To insure complete success in this exchange of heat it is necessary to introduce the raw material in a convenient shape. The invention of Dr. Lellep covers the forming of the raw meal into small balls (nodules) by the addition of a small percentage of water. The balls are in contact with each other only on very small surfaces and thus the layer of raw meal on the traveling grate in the form of nodules is easily permeated by the gases under suction. Furthermore, as the gases are thoroughly split up by the great number of small balls, an ideal transfer of heat from the gases to the nodules is obtained. With a layer of normal portland cement raw meal 6 to 8 in. thick and a water content of 12 to 14% by weight on the traveling grate, such a perfect transfer of heat takes place when the waste gases have a temperature of about 1650 deg. F. that the nodules at the bottom of the layer can be below 212 deg. F. while the upper layer may be calcined to a con-

*O. Lellep, Warmetechnische Untersuchungen über den Wärmehaushalt beim Zementbrennen. Verbund-Rost-Drehofen. Dissertation. Techn. Hochschule Braunschweig 1930.

E. Schirm, Brennen von Zement auf dem Wanderrost. Tonindustrie-Zeitung 1930, p. 978.

Editors' Note

THIS ARTICLE describes a dry process rotary kiln which is said to burn a barrel of cement with 45.2 lb. of coal. A number of such kilns are now working commercially in Europe.

The article is a report on this kiln worked out as a result of an inspection trip by a committee consisting of Prof. Dr. W. Eitel, director of Kaiser Wilhelm Institute for Research of Silicates, Berlin-Dahlem, Alfred Mueller, president of the cement works at Ruedersdorf, near Berlin, and Dr. Karl Gosslich, editor of Tonindustrie-Zeitung, Berlin.

The original data covering the tests and description were in the metric system and this has been converted to American standards.

—The Editors.

siderable extent. At the same time the average temperature of the exit gases will be about 300 deg. F., so that the traveling grate is not exposed to excessive temperatures.

This idea of utilizing the sensible heat in the rotary kiln gases on the traveling grate by nodulizing the raw meal shows striking advantages for the economical operation of such a plant. First, the waste gases can escape into the chimney at a low exit tem-

perature, so that the waste heat losses are reduced to a minimum. Furthermore, the dust content of the waste gases is reduced to practically nothing, because the lower layers of nodules on the grate, which have the lowest temperature, are in most cases still damp and will absorb the dust particles like a filter. A plant using this principle will avoid practically all the losses of raw meal caused by the dust content of the waste gases. The uniform ball-shaped form of the nodules, which is retained during the burning, makes the clinker particularly suitable for being ground in the finishing mill. The evaporation of the water contained in the nodules leaves them porous, and during the burning process the clinker balls also remain porous, thus reducing their resistance to grinding.

Another considerable advantage to a cement plant using this is the possibility of considerably shortening the length of the rotary kiln. According to the principles in use up to the present time, large kilns 330 ft. or more in length have been used; the rotary kilns required for a Lepol plant, in order to finish the burning, will have a length of only 80 to 120 ft. The mechanical construction of the kiln is, therefore, greatly simplified and the safety of working is increased. The operation is not rendered more difficult by the traveling grate, as the links are exposed to only a moderate heat.



Group picture taken at plant

1. Mr. Riccardo Rezola, owner of the plant Cementos "Rezola" S.A., San Sebastian, Spain.
2. Mr. José Maria Rezola, his son.
3. Mr. Julian Rezola, his son.
4. Mr. Irastorza, plant manager.
5. Professor Dr. Wilhelm Eitel.
6. Dr. Karl Gosslich, editor of "Tonindustrie Zeitung."
7. Mr. Alfred Mueller, president and general manager, D. P. Z. F. "Adier" A. G., Ruedersdorf, Germany.

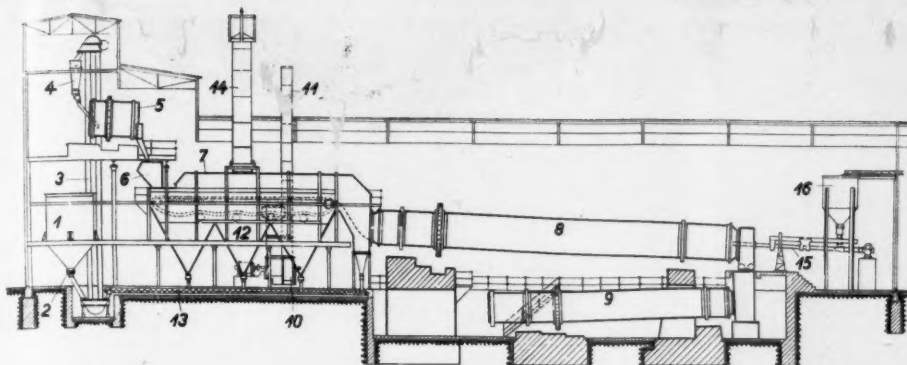


Fig. 1. Diagram of Lepol kiln

This invention has been developed by Messrs. G. Polysius, A.G., of Dessau, who have introduced the Polysius-Lellep process in the form of their Lepol kiln. The construction of the apparatus, according to the invention of Lellep, does not involve any difficulties of importance; in fact, a Lepol plant is distinguished by surprising simplicity. In addition to a short, normal rotary kiln with powdered coal firing and a normal cooling drum for clinker, there has been added a closed chamber for enclosing the traveling grate and a chute for connecting the chamber to the rotary kiln. A short hydroballer drum to nodulize the raw meal, with the addition of a certain quantity of water, is a necessary auxiliary part of the traveling grate equipment. The nodules are delivered directly on the grate by means of a hopper. As they pass through the chamber the water content is evaporated, and as the heat of the waste gases of the rotary kiln is absorbed they are partly calcined. Then they drop by means of a chute into the short rotary kiln, where the calcination is finished and in the hot zone of which the clinker burning is completed. The further procedure from the end of the rotary kiln down the chute and through the cooling drum corresponds to the normal rotary kiln plants. The clinker transfers a considerable part of its heat to the air, which is introduced through the cooler and which flows to the powdered coal flame as preheated combustion air. The noticeable heat of the clinker at the discharge represents one unavoidable loss of heat. It is quite evident that the short rotary kiln plant means a considerable reduction of the losses from radiation. The thermo-economical superiority of such a unit is readily recognized when the intense exchange of heat between the waste gases and the nodules is realized.

Description of Process

Following is a brief description of a Lepol plant according to Fig. 1:

The raw meal is handled from a silo (1) by a screw (2) and an elevator (3) into a small feeding bin (4). From this bin, the raw meal is uniformly fed to a drum (5), where it is subjected to a fine spray of water, and by means of rotation the nodules

are formed; these are collected in a hopper (6), which feeds the traveling grate (7). The material passes over the slowly moving grate to the kiln (8) and from the kiln in the usual manner to the cooler (9).

The hot gases pass in countercurrent through the kiln and by means of a fan (10) are sucked through the layer of nodules and the grate (7), to be finally discharged through the stack (11).

The particles falling through the grate are collected in air- and dust-tight hoppers (12) and returned to the elevator (3) by means of a screw conveyor (13). On top of the grate enclosure is placed an auxiliary chimney (14) which can be closed by a flap damper. This chimney is used only in starting the plant. During normal manufacture it is closed, so that the hot gases are compelled to pass through the grate.

Fig. 2 shows a longitudinal section through the traveling grate. The chamber over the grate is formed by a casing of plate iron which is entirely lined with refractory blocks. Losses from radiation are avoided by a layer of heat insulating material be-

tween the plate iron enclosure and the refractory lining.

Fig. 3 shows the upper end of the short rotary kiln with bearing and drive, as well as the connection between rotary kiln and traveling grate. On the left hand can be seen the chimney above the fan, while above the grate chamber the lower end of the auxiliary chimney is shown. It also shows how access is obtained to the different parts of the plant by staircases and gangways.

Fig. 4 is a view of the grate chamber and the hydroballer drum arranged above it.

Fig. 5 shows the interior of the grate chamber and the surface of the grate, which is formed by inserting oscillating perforated grate bars of cast iron between strong chains of cast steel. Above, in the ceiling of the grate chamber (which is not yet lined) can be seen the opening for the auxiliary chimney.

Fig. 6 shows the lower returning part of the grate chain and also very clearly shows the grate links oscillating between the chains.

The economic crisis has unfortunately prevented the German cement industry from installing in their own country a large number of Lepol plants. For this reason this report is based on a plant at San Sebastian, Spain, which may be considered as an example of a number of plants which have been erected abroad. The Lepol unit not only turned out very well for the manufacture of portland cement, but also for the manufacture of slag cements, for which we have investigated a large Lepol plant at Esch, Luxemburg, using the same methods employed at the plant in San Sebastian.

The plant in San Sebastian was investigated thoroughly in order to ascertain the working economy. The thermo-economical

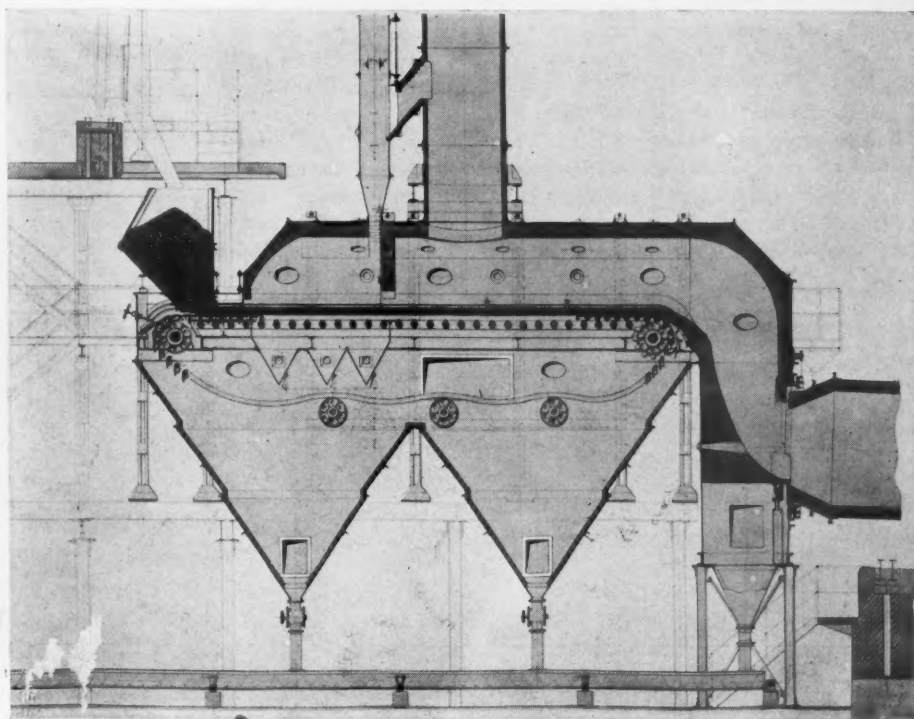


Fig. 2. Longitudinal section of traveling grate

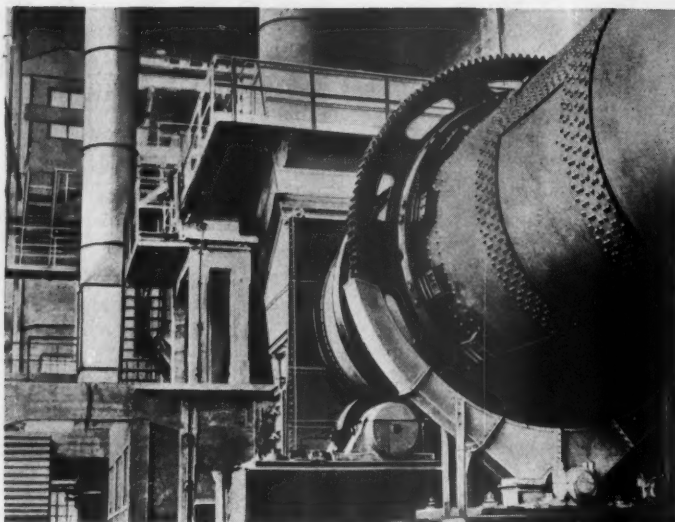


Fig. 3. Upper end of rotary kiln with connection to traveling grate

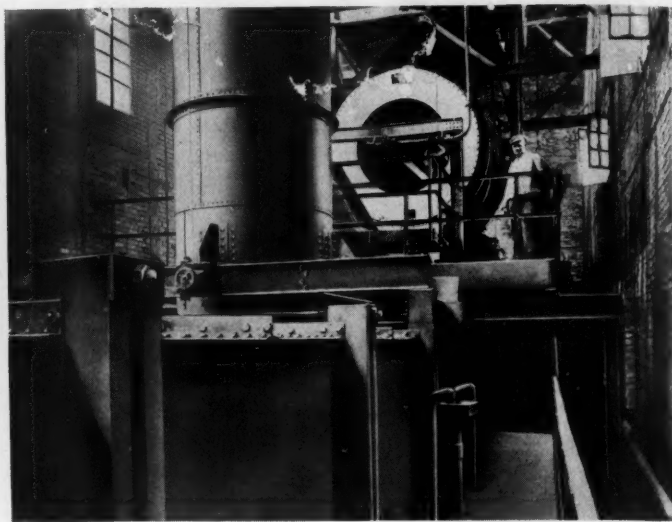


Fig. 4. View of grate chamber below with hydroballer drum above

report according to tests made October 23, 1931, follows:

1. *Kiln Output.* The clinkers were weighed on an automatic weighing machine immediately after leaving the cooler. During a 24-hr. period there were observed 3726 dumps of the tip-bucket. Each dump took place at an average load of 141 lb. of clinker. The total quantity of the product was therefore 1387 bbl., corresponding to an average output of 57.8 bbl. per hour. The output per cubic foot of kiln volume was 3.79 lb. per hour, or 0.2399 bbl. of clinker per 24 hours, with an inside kiln volume of 5756 cu. ft. and an effective grate surface of 258.3 sq. ft.

The temperature of the clinker at the outlet of the cooling drum averaged 660 deg. F. The temperature of the secondary air of combustion between rotary kiln and cooling drum was not measured in this case; but, according to measurements at other Lepol plants, it will very closely approach 1380 deg. F.

2. *Coal Consumption.* During the period indicated above there was fired 62,963 lb. of a powdered coal, consisting of two parts of a fat Asturian coal (Turón) and one part of a Spanish anthracite. The analyses of these coals are given in the table which follows:

<i>Turón (fat):</i>	
Water content (230 deg. F.).....	0.56%
Ash	9.34%
Volatile matter	26.36%
Lower heating power, B.t.u./lb.....	13,200
<i>Anthracite (Spanish):</i>	
Water content (230 deg. F.).....	1.10%
Ash	19.73%
Volatile matter	6.07%
Lower heating power, B.t.u./lb.....	11,980
<i>Mixed (2 parts Turón, 1 part anthracite):</i>	
Content of water (230 deg. F.)....	0.61%
Ash	13.34%
Volatile matter	18.55%
Lower heating power, B.t.u./lb.....	12,865

The ash of the mixture had the following composition:

SiO ₂	48.25%
Fe ₂ O ₃	15.26%
Al ₂ O ₃	18.94%
CaO	9.20%
SO ₃	4.60%
Remainder (probably alkalis).....	3.75%

The moisture content of the coal was 1.5 to 3% at the inlet of the drying drum and 0.5 to 0.8% at the outlet. The fineness of the powdered coal amounted to 0.1 to 0.4% residue on the 900-mesh sieve (76-mesh per linear inch) and to 3 to 6% residue on the 4900-mesh sieve (178-mesh per linear inch). If the moisture of the powdered coal, as fired, is assumed to average 0.6%, the above consumption of 62,963 lb. of wet coal would correspond to 62,586 lb. of dry coal. This is

11.9% of the weight of clinker (1387 bbl.). Based on the heating value of the powdered coal mixture of 12,865 B.t.u./lb., we have a heat consumption of 581,500 B.t.u./bbl., or 45.2 lb. of coal per bbl.

3. *Composition of the Raw Meal.* Three kinds of stone from the quarries are used, which differ as follows:

	Margas high-lime	Arro-beta I low-lime	Amazor-rain II	Ando-sin III
	Pct.	Pct.	Pct.	Pct.
Loss in burning....	36.75	32.67	38.38	43.38
SiO ₂	10.23	17.65	9.09	1.02
Al ₂ O ₃	4.00	6.34	1.82	0.52
Fe ₂ O ₃	2.00	2.56	1.14	
CaO	46.00	39.20	48.80	54.90
MgO	0.68	0.69	0.42	0.20
SO ₃		0.24	0.38	
CaCO ₃ (average)	72.00	77.00	86.00	98.00

For mixing the raw meal, three parts of limestone I and one part of limestone II are used, the composition being corrected by additions of the very pure limestone III.

EXAMPLES OF TWO RAW MEALS

	I	II
Loss due to burning.....	35.36%	35.88%
SiO ₂	13.65%	12.34%
Al ₂ O ₃	4.71%	3.12%
Fe ₂ O ₃	1.69%	2.80%
CaO	43.68%	44.04%
MgO	0.88%	0.23%
CaCO ₃	77.2%	78.0%

The fineness of the meals is between 0.4

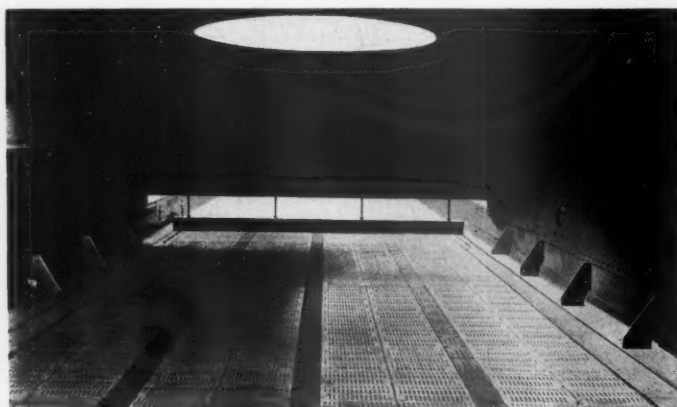


Fig. 5. Interior of grate chamber before being lined

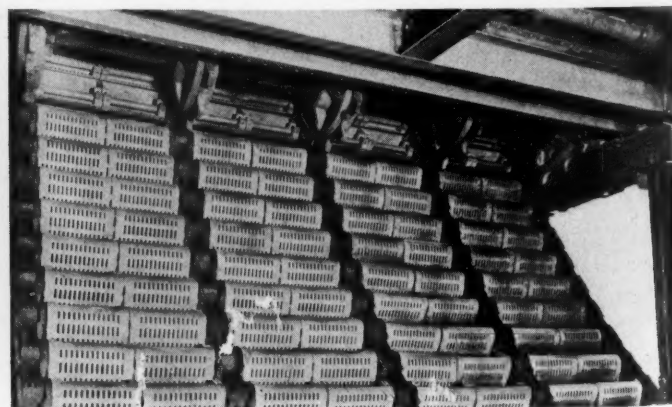


Fig. 6. Lower return part of chain grate

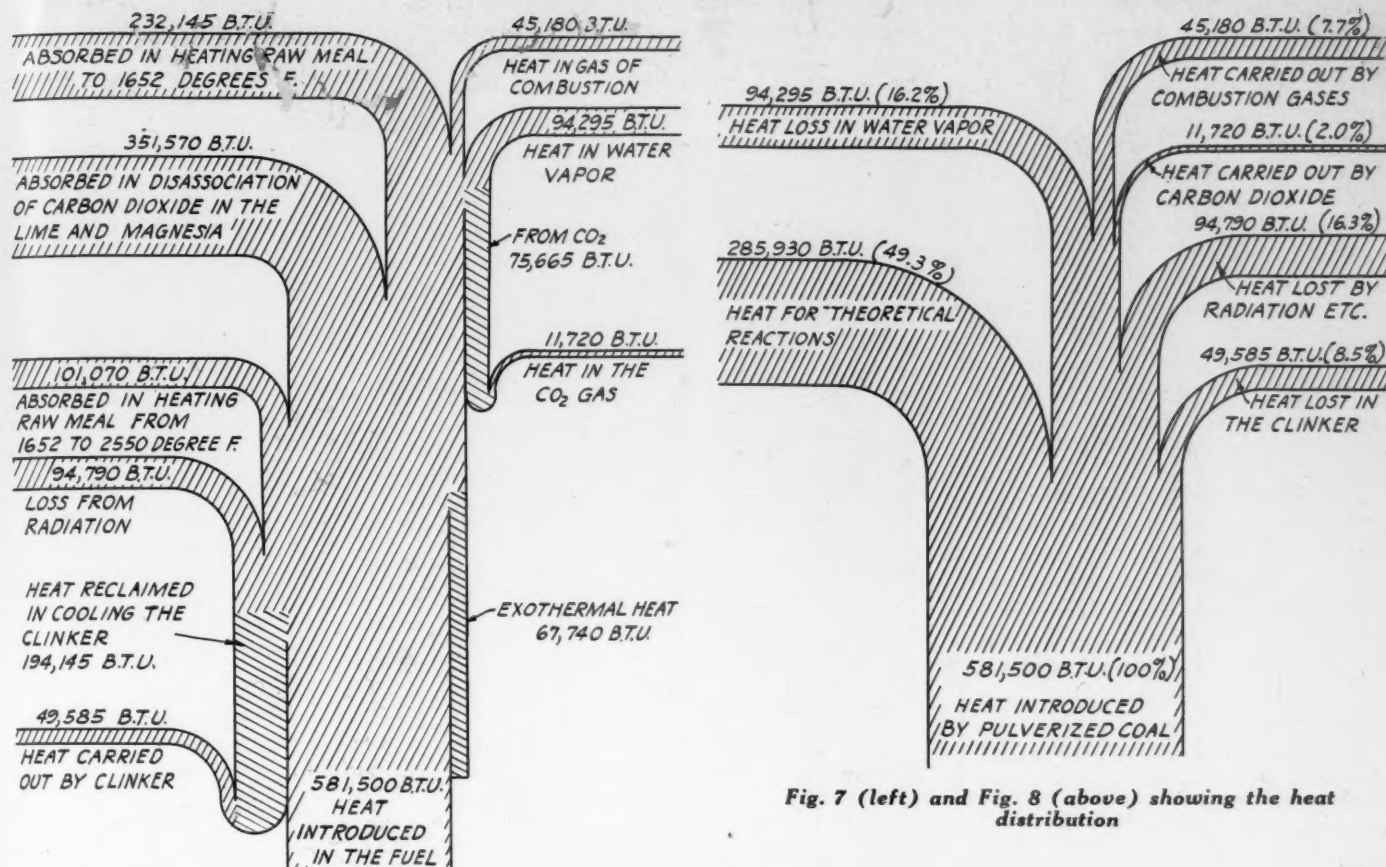


Fig. 7 (left) and Fig. 8 (above) showing the heat distribution

and 0.8% on the 900-mesh sieve (76-mesh per linear inch) and between 10.2 and 12% residue on the 4900-mesh sieve (178-mesh per linear inch). The raw meal II was to be made expressly for the operation of shaft kilns, because at these kilns, which have a great loss of dust, there is a surprising reduction of lime content in the raw mix. In the case of the Lepol kiln there is scarcely any loss of dust, thus the lime content of the raw mix can be lower. For this kiln, mix I has been used.

The raw meal entering the Lepol plant is nodulized with the addition of 12% water and then drops to the grate. The sizes of the nodules, which were uniform in shape, are shown in the screen analysis following:

English sieve size	Mesh opening	Per cent. of each size
No. 50.....	0.300 mm.	0.1%
No. 30.....	0.589 mm.	0.3%
No. 16.....	1.168 mm.	3.0%
No. 8.....	2.362 mm.	19.9%
No. 4.....	4.699 mm.	47.7%
No. 3.....	9.423 mm.	24.9%
No. 2.....	18.850 mm.	4.4%

The original CaCO₃ content of the (dry) raw meal, which is 77.2%, as above stated, must be considered in the calcination process. The remainder of the existing CO₂ is combined as MgCO₃ and must be taken into account accordingly. The nodules are fed on the grate in a layer 6.7 in. deep and at a speed of 100 ft. per hour (the speed of the driving shaft of the grate is 12½ revolutions per hour).

The temperatures in the first chamber (drying chamber) above the grate were measured directly by means of an iron-

constantan-thermo-couple, and were as follows:

Above the grate—572 deg. F. (showing air leakage).

Under the grate—below 212 deg. F.

The draft corresponding to these conditions was:

Above the grate—0.394 in. water column.

Below the grate—1.18 in. water column.

In the main or hot gas chamber the following temperatures were measured:

Above the grate—1470-1650 deg. F.

Below the grate—140-175 deg. F. (showing air leakage).

The draft corresponding to these conditions was:

Above the grate—0.39 in. water column.

Below the grate—2.36-3.94 in. water column.

The temperature in the chute between the grate and the rotary kiln was 1616-1688 deg. F., which temperature is sufficient for calcination. Analyses of the gas at the end of the rotary kiln were not taken, but the nodules were partly calcined (about 20%) when passing into the rotary kiln.

The quality of the clinker burned was very good and remarkably uniform. The apparent porosity of the clinker nodules is a striking feature. No underburned or overburned clinker was found nor any containing free lime.

The analysis of the clinker was as follows:

SiO ₂	20.48%
Insoluble.....	0.20%
Al ₂ O ₃	7.01%
Fe ₂ O ₃	2.97%
CaO.....	63.85%

MgO.....	1.38%
SO ₃ (including gypsum).....	2.05%
Hydraulic modulus.....	2.09

The qualities of the cement produced from this clinker can be seen from the following figures of results of tests made according to German standard specifications. The cement was ground in the laboratory mill with an addition of 3% gypsum, to a fineness of 4.8% residue on 4900 meshes (or 178 meshes per linear inch) and 0.2% residue on 900 meshes (or 76 meshes per linear inch). The setting time with 25% water began at 2.45 hours and ended at 5.30 hours. Boiling, steam-drying and standard tests were passed satisfactorily.

Tests made according to German standard methods showed the following strength of mortar (with 8% water):

	Tension lb./sq.in.	Compression lb./sq.in.
After 2 days.....	459.5	5148.4
After 3 days.....	497.8	5973
After 7 days.....	550.4	7083
After 28 days under water.....	589.3	7908
After 28 days combined.....	722.5	9061

4. Quantity of Air for Combustion. For combustion of the powdered coal a high pressure blower is used, producing an average air pressure of 37.8 in. water column, with a capacity of about 1893 cu. ft. per minute (calculated at an atmospheric temperature of 60 deg. F. and at a height of the barometer of 29.52 in. Hg). The amount of air required per hour is 113,590 cu. ft., which is used in conjunction with the consumption of 2609 lb. of dry coal per hour.

On the heat balance to be made later on,

the amount of excess air must be taken into account. That is, the ratio of the total amount of air furnished to that theoretically required amounts to 1.1 to 1.2.

The quantity of air theoretically required for complete combustion is about 99.5 normal cu. ft. per lb. of coal; that is, about 120 normal cu. ft. with excess air of 1.2. This requires 310,770 normal cu. ft. of air per hr. The full output of 113,590 normal cu. ft. of the blower is not utilized for the continuous maintenance of the combustion, but a part of the air is returned by a valve to the suction side of the blower; 15 to 20% of the air required for combustion is, therefore, blown into the kiln as primary air.

Theoretical Heat Balance

For ideal kiln burning, without any losses, and with a clinker exit temperature of 32 deg. F., the same exit temperature of the waste gases and the same initial temperature of the raw meal, and eliminating all losses due to radiation, transmission and convection, the following results will be obtained:

I. Heat Used

a. Heating the raw meal from 32 deg. F. to the temperature of calcination (1650 deg. F.), 380 lb. or 1 bbl. of clinker requires, with 35.56% of volatile matter (CO_2 and H_2O), 586 lb. of raw meal. The average specific heat of the raw meal from 32 to 1650 deg. C. can be assumed as approximately 0.246 (calculated from the specific heat of the clinker and CO_2). The resulting heat expenditure is thus 232,200 B.t.u. per bbl.

b. The heat consumption for the dissociation of the calcium and magnesium carbonate in the raw meal is calculated from its CO_2 content of 35.56%. This equals 206 lb. in 586 lb. of meal, equivalent to 11 lb. of MgCO_3 and 459 lb. of CaCO_3 . Five pounds of the CO_2 are to be driven out of the magnesium and 201 lb. out of the calcium carbonate. The heat consumption for this, for 1 lb. of CaCO_3 , amounts to 757 B.t.u. and for 1 lb. of MgCO_3 to 370 B.t.u. Consequently for the raw meal the heat consumption is:

Dissociation of CaCO_3347,500 B.t.u.
Dissociation of MgCO_3 4,070 B.t.u.

Total.....351,570 B.t.u.

We have not taken into account in the following heat balance the heat required for driving the water out of the clay substance in the marl of the raw meal. We have adopted the general usage for the statement of heat balances of portland cement kilns, according to which this heat consumption as well as the calculation of the loss of heat out of the water vapor in the waste gases has been neglected. This is perhaps not quite correct, as, according to W. M. Cohn (German Ceramic Association IV. 1923, p. 55), the amount of heat consumed for this is 169 B.t.u./lb., but this would entail a correction of small importance to the heat balance.

c. The heating of the calcined material

from 1650 deg. F. to the finishing temperature of 2550 deg. F. can be assumed at this lower limit of 2550 deg. F. owing to the porous quality of the clinker. The resulting specific heat of the clinker from 32 to 2550 deg. F. is 0.257 and the heat consumption = 101,070 B.t.u. per bbl.

II. Heat Recuperation

a. The exothermic effect of the formation of the clinker is a benefit to the economical heat consumption of the rotary kiln. The vitrification disengages, according to Nacken,* about 100 calories per kilo, or 178 B.t.u. per lb. = 67,740 B.t.u. per bbl.

b. The heat contents of the CO_2 driven out at 1650 deg. F. will be used again in the calcination and drying process; the average specific heat of CO_2 (1kg.) from 32 to 1650 deg. F. is 0.263, so that for the 206 lb. CO_2 there are required for the calcination 87,385 B.t.u.

c. Cooling of the clinker from its maximum temperature of 2550 deg. F. to 32 deg. F. disengages at an average specific heat of 0.257 = 243,730 B.t.u.

The total theoretical heat balance shows, therefore:

	B.t.u.
Heat used, Ia, Ib, Ic.....	684,785
Heat recuperated, IIa, IIb, IIc.....	398,855
Then the theoretical heat consumption for burning 1 bbl. of clinker amounts to	285,930

The real heat consumption for burning 1 bbl. of clinker has been ascertained to be 581,500 B.t.u. per bbl.; therefore, a relative efficiency of 49.3% compared with the theoretical is attained by the Lepol unit.

Practical Heat Balance

	B.t.u./bbl.
1. Heating of the raw meal to 1650 deg. F.	232,145
2. Calcination of the raw meal at 1650 deg. F.....	351,570
3. Heating of the calcined raw meal to the finishing temperature of 2550 deg. F.....	101,070
Total.....	684,785

From these figures is to be deducted the recuperated heat as follows:

	B.t.u./bbl.
4. a. The clinker waste heat from 2550 deg. F. down to 660 deg. F., which is the temperature at the outlet of the cooler (sp. heat, 0.257 and 0.209 resp.)	194,145
b. Heat recovered from the carbon dioxide gas liberated from the raw meal at 1650 deg. F. down to exit gas temperature (about 300 deg. F.).....	75,665
c. Exothermic heat developed in the chemical formation of the clinker	67,740
Total.....	337,550

5. Evaporation of the water contained in the nodules fed to the grate with an average water content of 12%:

*R. Nacken, Thermochemische Untersuchungen an Zementrohmehl und am Zement. Zement 1922, p. 245.

80 lb. of steam at 212 deg. F.....	90,975
Superheating to 300 deg. F.....	3,320

Total	94,295
6. Loss by clinker waste heat at 600 deg. F.....	49,585
7. Waste gas losses:	
a. Combustion gas volume, 171.3 normal cu. ft. per lb. of coal, or, for 45.2 lb. of coal, 6738 normal cu. ft. of combustion gases. These have an exit gas temperature of 300 deg. F.....	45,180
b. The carbonic acid expelled from the raw meal has at a waste temperature of 300 deg. F. a heat content of	11,720

The total quantity of waste gases amounts to 11,210 normal cu. ft. per bbl. of clinker. The fresh air infiltration below the grate is without importance for the heat balance.

Therefore the following practical heat distribution is attained in the Lepol plant:

	B.t.u./bbl.
The raw meal fed to the kiln plant must be heated to 1650 deg. F. This requires	232,145
The calcination of the raw meal at 1650 deg. F. requires.....	351,570
The heating of the raw materials from 1650 deg. F. to 2550 deg. F. requires	101,070
Total.....	684,785

This quantity of heat includes 87,385 B.t.u./bbl., which are contained in the carbonic acid expelled from the raw meal at 1650 deg. F. However, 11,720 B.t.u./bbl. are lost as waste gas heat at 300 deg. F., so that only 87,385 - 11,720 = 75,665 B.t.u./bbl. can be used for the kiln process. These are to be deducted from the above sum.....

Leaving.....	609,120
Furthermore, there is to be deducted the heat from the exothermal effect in the formation of clinker.....	67,740
Remainder.....	541,380

One barrel of clinker is thus produced, which has a temperature of 2550 deg. F. and a heat content of 243,730 B.t.u. 49,585 B.t.u. are lost, in the sensible heat of the clinkers leaving the cooler at 660 deg. F., so that only 243,730 - 49,585 = 194,145 B.t.u. are transferred to the air for combustion. Consequently there are to be deducted

Leaving	347,235
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There are to be added:
The loss of sensible heat in the gases of combustion, which escape at a temperature of 300 deg. F..... 45,180
The loss of heat in the water evaporated from the nodules at 300 deg. F..... 94,295

Total	486,710
Loss by radiation, etc., as difference..	94,790

Effective heat consumed per bbl. of clinker in the form of powdered coal

This distribution of heat is represented in Fig. 7. The following figures are shown graphically in the Sankey diagram, Fig. 8:

	B.t.u./bbl.	Pct.
Theoretical heat consumption.....	285,930	49.3
Water vapor	94,295	16.2
Combustion gases at 300 deg. F.	45,150	7.7
Carbonic acid at 300 deg. F.	1,720	2.0
Radiation	94,790	16.3
Clinker heat at 662 deg. F.	49,585	8.5
	581,500	100.0

The combustion gases, when passing from the rotary kiln to the traveling grate, have a temperature of about 1650 deg. F., which corresponds to a heat content of 260,800 B.t.u. There is still to be added the heat content of only that part of the carbonic acid which is expelled from the raw meal in the rotary kiln. Therefore it can be said that about half of the 581,500 B.t.u./bbl. in heat produced by combustion will be delivered to the grate.

Lower Coal Consumption Results in Overall Power Savings

The above figures on the thermo-economical operation of the Lepol unit show a considerable superiority over previous rotary kilns. The question now arises whether the adoption of the traveling grate and the power consumption necessary for its drive, as well as the necessity of the installation of a fan, the motor drive of the hydroballer drum, etc., require such a high power consumption that a considerable part of the thermo-economical advantages would be lost. Therefore, a summary of the power consumption of the machinery for this department is given.

The power consumption of the Lepol plant, amply provided for, is as follows:

Hydroballer drum	18.5 kw.
Grate	3.5 kw.
Rotary kiln	20.0 kw.
Cooling drum	12.0 kw.
High pressure blower.....	13.5 kw.
Exhaust fan for the waste gases.....	42.0 kw.
	109.5 kw.

This amounts to 2628 kw.-hr. per day, or 1.91 kw.-hr. per bbl.

On the other hand, the power consumption of a rotary kiln plant of the ordinary type will be as follows:

Mixing screw	25.0 kw.
Rotary kiln	29.0 kw.
Cooling drum	12.0 kw.
Fan for powdered coal.....	22.0 kw.
	88.0 kw.

or 2112 kw.-hr. per day and 1.54 kw.-hr. per bbl.

If one compares only the rotary kiln plants it appears that the power consumption of the Lepol kiln is indeed somewhat higher than the normal rotary kiln. This higher consumption is, however, fairly compensated by the reduced grinding work to produce the powdered coal. If the power consumption of the powdered coal preparation section is assumed to be 32.7 kw.-hr. per ton (2000 lb.) of powdered coal, the following comparison results:

Lepol Plant: 11.9% powdered coal this is 45.2 lb. per bbl. or 31.2 tons per day = 1030

kw.-hr. per day or 0.75 kw.-hr. per bbl. of clinker.

Normal Rotary Kiln Plant: An average of 1,017,000 B.t.u. per bbl. = 20% powdered coal, this is 76 lb. per bbl. of clinker, or 52.5 tons per day = 1717 kw.-hr. per day or 1.25 kw.-hr. per bbl. of clinker. Including the powdered coal preparation, the figures per bbl. of clinker are, therefore, the following: Lepol plant = $1.91 + 0.75 = 2.66$ kw.-hr. per bbl.

Rotary kiln plant = $1.54 + 1.25 = 2.79$ kw.-hr. per bbl.

The power consumption of a Lepol plant is, therefore, no more unfavorable than that of an ordinary rotary kiln plant.

Slag Cement Plant in Luxemburg

In addition to the present report on the operating results of the plant at San Sebastian, there may briefly be mentioned the analogous investigations at the Lepol plant of the Slag Cement Works at Esch in Luxemburg, on which we intend to report in the near future. This plant was built for an output of 1452 bbl. of clinker; but because of conditions existing at this factory the Lepol plant can only be operated at approximately 80% of its normal output. For a short test period, however, the output of the plant was increased up to 1599 bbl.

The preparation of the raw meal at this plant is of particular interest, as it is done by means of a new pneumatic mixing system, which will be described in detail in another publication.

The forming of nodules from the raw meal, containing blast furnace slags, offers no difficulties. In spite of the relatively unfavorable conditions of the low production rate, the coal consumption was considerably lower than the guaranteed coal consumption of 677,400 B.t.u. per bbl. of clinker. In a test it was only 562,900 B.t.u./bbl. The quality of the clinker is first class.

Comparing the Lepol plant with two old rotary kilns in the same works, it shows more economical production, in spite of the unfavorable conditions under which it has had to operate. The average heat consumed in the old rotary kilns during a period of three months was 1,219,000 B.t.u. per bbl. of clinker, while the Lepol plant at nearly the same production of clinker showed an average heat consumption of 569,000 B.t.u. per bbl. for three months. It is to be supposed that the heat consumption of the Lepol kiln will be still more favorable when the plant can operate at a normal rate.

It is also of importance that the raw meal consumption of 589 lb. per bbl. of clinker of the old rotary kiln plant was reduced to 529 lb. at the Lepol plant.

The above report will give an idea of the economical operation and the advantages of the Lepol process. As shown in the theoretical calculation, the heat consumption for the burning of cement is very decidedly reduced by this process.

Rubber Lining for Ball Mills

THE manner of applying and vulcanizing a rubber lining to a ball mill in the field is described by F. L. Haushalter, the B. F. Goodrich Co., Akron, Ohio, in a recent issue of *Industrial and Engineering Chemistry*.

The mill in point was one of a battery of 6-ft. by 8-ft. Abbe ball mills used for grinding silicanite slurry used in making spark plugs at the Detroit plant of the Champion Porcelain Co. These mills were lined with 2-in. porcelain blocks and the grinding was done by 1¼-in. porcelain balls, but it was believed that rubber might make a desirable lining and so in February, 1929, one mill was equipped with a 1-in. lining.

This was done at the plant, using ¼-in. unvulcanized rubber slabs and applying them by the Vulcalock process. The inside of the mill was sand-blasted, wiped clean with high-test gasoline, and three coats of Vulcalock cement applied to the metal. The ¼-in. rubber was then carefully laid on and fitted to obtain a tight job. Rubber cement was applied to the rubber as each ply was added until the total thickness of 1-in. or 4 plies was obtained.

In curing the lining a flat steel plate 1-in. thick with pipe connections for steam and air was bolted over the manhole. Curing was done for 5 hr. at 40-lb. steam pressure, with a 1 hr. cool-down under 40 lb. air pressure.

It is stated that the mill has now been operating almost continuously for about 2½ yr. and that the rubber shows very little sign of wear and no defects.

Barite Deposit in Arkansas

THE ARKANSAS Geological Survey, under the direction of George C. Branner, state geologist, has issued Information Circular No. 1, A Barite Deposit in Hot Spring County, Ark.

The presence of barite in the northwest part of Hot Spring county has been known since about 1900. Until 1930 no serious attempt was made to prospect the locality. Since this time a test shaft has been sunk, 27 trenches and pits dug, and 34 holes drilled. Ninety chemical analyses and two flotation tests have been made. A geological survey has been made, both of the deposits and the adjacent area, to determine the extent and origin of the barite.

The greatest known thickness of the barite stratum is 44 ft., measured normally to the bedding plane. It is probable that at least 1,000,000 tons of barite over an area of about seven acres are available 100 ft. or less below the surface.

Averages of 15 chemical analyses of the barite give 86.10% barium sulphate, 10.29% silica, 1.28% iron and alumina, and small percentages of magnesium, calcium and titanium oxides. Flotation tests indicate that concentrates having a tenor of 97% barium sulphate can be obtained.

Economics of the Nonmetallic Mineral Industries*

Part XIII—Large Versus Small Companies

By Raymond B. Ladoo

Manager of the Industrial Commodities Department, United States Gypsum Co.

PERHAPS the most outstanding feature of business today is the passing of the small company and the growth of large companies with nation-wide production and distribution facilities. Sometimes this is accomplished by mere growth, but more often it is done by combinations, mergers or the purchase of weak companies by stronger ones. This is truly an era of mass production, mass finance and mass distribution. A small single plant company today has little chance of outstanding success unless it produces a highly specialized product which is in some way unique—that is, made from a unique material closely controlled, or a product protected by sound patents or some other monopolistic feature. Even in such cases unusual success cannot be expected for a very long time. Other deposits are found, substitute materials are developed, patents are infringed or side-stepped, and so on. Patent litigation is long drawn out and expensive and judgments after successful law suits are often hard to enforce. Few small companies have the resources to fight a patent suit through to a successful conclusion against a large corporation.

This condition should, but usually does not, deter people from starting up new small companies in already overcrowded fields. In most instances the companies start up, lead a short and precarious existence and die an early death. This does not mean, of course, that no small, single unit companies are justified and that none can and do succeed. There are plenty of examples of successful small companies and conditions sometimes indicate the need of operations of this type. But such instances are becoming rarer each year. The time has come when conditions surrounding the foundation of a proposed small company must be very carefully studied.

This trend of modern business has an important bearing on the economic value of many deposits of nonmetallic minerals. A deposit may become the basis of a profitable producing unit of a large company when this same deposit in the hands of a small single plant producer could never be put on a paying basis. The small producer lacks the necessary capital to build the most efficient plant—he lacks the efficient distribution

Editors' Note

IN THIS ARTICLE the author discusses the trend toward large companies and some of the differences between large and small corporations.

While it is evident that a large corporation may differ from a small one in many ways besides mere size, he concludes that if properly managed the large corporation has advantages over the small one.—The Editors.

facilities, the nationally advertised brand names, the funds for research, the ability of high caliber executives, and so on.

But small companies may have their advantages—advantages which larger companies often cannot equal. In small companies the responsible executives are in close touch with every detail of the business. Customers are often close personal friends. Since operations are conducted on a small scale it is often easier to make special grades and types of materials to meet special needs of a customer than it is in the large plant designed and operated to produce one or two standard products on a mass production basis. Often small companies thrive on special business which large companies cannot handle economically or with which they will not be bothered.

When small companies grow large the executives do not have time to handle all the details they formerly did, but they often attempt to. They use up their time and energy struggling with petty details and trying to handle the larger matters of policy, planning, and so on, at the same time. They are not willing or able to delegate final authority to their staff. Consequently important matters of company policy receive too little thought and attention and petty details are either held up unduly awaiting executive action or are buried and lost sight of entirely. It is true that such delay sometimes has its advantages in that hasty and ill-considered action is avoided. Many fine ideas do not look so good when they are dragged out of a pigeon hole after months delay. But the disadvantages outweigh the advantages. Many fine suggestions are al-

lowed to die without a fair trial—individual initiative is deadened and enthusiasms are killed. Final authority often can and should be more widely diffused in many large and rapidly growing companies. Staff men "on the firing line" should first be selected and tested with great care, properly trained for their jobs, and then entrusted with final authority to deal with all but the most important matters on subjects about which they alone have all of the detailed information. It is often difficult for executives who have grown up with a business to realize that there are other men of ability in their employ who can and do learn the business as thoroughly as themselves, who have as good judgment and, what is most important, have all the up-to-date, detailed facts which they themselves used to have but no longer possess.

One of the greatest disadvantages of a large company with many plants and offices, a large number of employees and a wide diversity of products, is that often the minor executives do not take the same interest and have the same enthusiasm and initiative as the owners and officers of a small single plant company. Often the larger the company the less efficient it is in the operation of its unit plants. This is not always true, as the efficiency of some large companies proves, but it is too often the case. The trouble is partly due to the sheer inertia of a large body and in part due to lack of perspective, foresight and organizing ability of the chief executives.

There is another side to the personnel and organization problem, however, which favors the large corporation. In a well managed corporation the younger executives often have a wider scope for their abilities than in a small company due to the greater financial resources of the large corporation which permit the carrying out of larger projects. While the executive in a small company may not have important organizational difficulties to contend with, he often is tied down to a narrow scope for his work due to economic necessity.

A large corporation can and usually does comb the country for the most able men. This means that the younger executives are associated with men of high caliber from whom they can learn much and with whom they can work most effectively. Small com-

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panies sometimes afford this type of leadership, but not so often.

As a company grows and expands the form of organization must be continually studied and changed to meet changing conditions. Functions performed in a small company must often be split up and done by several individuals in a larger company and their work must be properly coordinated. Entirely new functions must be provided for. Problems which affect the company as a whole, that is non-departmental problems, must be cared for and such problems often demand a separate department or division to handle them. It is evident or should be evident that a large corporation differs from a small company in many ways, much more vital than mere increase in size.

(To be continued)

Production of Hydraulic Lime from Diatomaceous Marl

ALTHOUGH centuries of experience in Europe have proved hydraulic lime satisfactory and durable, yet in America there are but relatively small quantities of this kind of lime produced. Therefore, when the Kansas Geological Survey requested that a sample of diatomaceous marl from Kansas be examined as a possible source of hydraulic lime, the bureau agreed.

From a study of heating curves of the diatomaceous marl (which was essentially finely divided calcium carbonate containing about 18% by weight of diatomaceous silica) it was evident that a reaction was taking place between the lime and the silica at about 300 deg. to 400 deg. C. lower than in a mixture of chalk containing 18% of finely ground quartz.

Samples of the diatomaceous marl were then calcined in an electric furnace at definite temperatures for varying lengths of time. A "free lime" determination was then made on each calcined sample and sufficient water was added to react with this CaO to convert it to $\text{Ca}(\text{OH})_2$. Briquets were made from this partially hydrated material after it had aged a week in a closed vessel after the addition of water to permit the CaO to become hydrated. The briquets, were then stored for seven days in the molds in saturated air and maintained at 21 deg. C. They were then stored under water.

It was found that the strength of the briquets was improved if the partially hydrated lime was ground so that about 90% passed a No. 200 sieve. About 65% of the dry hydrate passes this sieve if unground. Apparently the best hydraulic lime (as far as early strengths are concerned) resulted from calcining the diatomaceous marl for about an hour at a temperature between 950 deg. and 1000 deg. C. Briquets made from the ground hydrate developed at the end of 28 days on the average a tensile strength of 230 lb./in.² and at the end of 90 days about 360 lb./in.²—*Technical News Bulletin* of the U. S. Bureau of Standards.

Motorizing Crushed Stone Plants

IN THE *Crushed Stone Journal* for December, 1931, D. Lee Chestnut, General Electric Co., Trenton, N. J., gives worth while information on the proper motorization of crushed stone plants.

First, he urges the checking up on old installations, even though they have not given any trouble, and making sure they are economical and suited to present conditions.

The use of an individual motor on each machine is considered a good investment, generally speaking. Induction motors should not be oversize, should be of the highest speed suitable for the particular drive, and synchronous motors should be used where practical, for a satisfactory power factor. Also, unnecessary handling of the material should be eliminated and the stone flow averaged as much as possible in order to keep down both the equipment size and the power demand.

Crusher Drives

The slip-ring induction motor is most widely used for crushed drives and is better adapted than any other type to starting a crusher which has been stopped when loaded. This is particularly true when the motor is equipped with a reversing drum controller so that it may be reversed to dislodge any stone which has locked the crusher head.

Squirrel-cage motors can be used equally well if the crushers can be started without load, as they have the same peak load capacity, with lower cost and maintenance. The recently developed high-starting-torque squirrel-cage motor offers a compromise here and many successful installations have been made on gyratory crushers, particularly in sizes below 75 hp. A two-step starting compensator is desirable, which should be push button operated. Standard squirrel-cage motors should not be applied to crushers having severe starting requirements.

The present types of synchronous motors are not as well adapted to crusher drives as those mentioned. The common flat belt drive from motor to crusher is probably more justified than in any other crushed stone plant application, as its slippage serves to relieve the peak load strains on both crusher and motor. Short center V-belt drives have been used very successfully and it has been recently suggested that with these a flat surface pulley be used on the crusher instead of the V-groove sheave, to allow a desirable slippage at times of peak load.

Conveyors, Elevators and Screens

High-starting-torque squirrel-cage motors with push-button-operated starters are recommended for driving rotary screens, belt conveyors, apron conveyors and bucket elevators, although slip-ring motors should have serious consideration in sizes above 100 hp. High-speed motors with good efficiency and power factor should be used, in connection with enclosed speed reducers. Machines such

as feeders requiring frequent starting and stopping should be driven by slip-ring motors.

Vibrating screens are best operated by high-starting-torque squirrel-cage motors, with V-belt drives. Although the starting requirements are more severe than might be expected, some operators have reduced any starting difficulties in cold weather by using a lower freezing point grease and regreasing the machines during the noon-hour instead of before starting time in the morning.

Electric Shovels and Haulage Systems

The modern electric shovel with individual heavy-duty direct current motors and Ward-Leonard control is extremely reliable and efficient.

Recent developments of the sectionalized-track, alternating current quarry haulage system have simplified and broadened the economical use of electric haulage.

General

Where slip-ring motors are subjected to stone, dust enclosed collector rings are desirable to reduce the wear of brushes and rings and to avoid the sticking of brushes.

Reduced voltage compensators should be used with squirrel-cage motors of the larger sizes for smoother starting and accelerating, and the contemplated use of across-the-line starters above 40-hp. sizes should be taken up with the power company.

Ball-bearing motors should not be fitted with Alemite or other pressure fittings, as grease under pressure is detrimental to these bearings. The housings should be only one-third to one-half full of grease and should not be regreased every day or every week, as twice a season is usually ample. Once a season at least the housing should be cleaned out and new grease put in.

Standard open squirrel-cage motors will withstand severe dust conditions without causing trouble, but in the case of small poorly ventilated enclosures the greater cost of totally enclosed fan cooled motors may be justifiable.

Provisions should be made so that the load on any motor can be easily and quickly determined. A permanently connected ammeter on every main motor is well justified and smaller motors should be arranged for easy connection with a portable ammeter.

The installation of a few emergency stop buttons, which are inexpensive, is an excellent safety-first precaution. Also, changing an old installation to modern enclosed control increases motor protection and reduces fire hazard.

A satisfactory plant must have motors able to keep running under all load conditions, but the motors should so far as possible be operated at full load or slightly above. Modern well designed motors will operate continually at 15% overload without injury and are guaranteed to have 50% momentary overload capacity, so that it is justifiable to load them up to where they will take care of some of the short time peak loads.

Quarrying and Crushing Basalt at Sodenberg, Germany

By Hans Leimbach, Dipl.-Ing.
Scheinfurt A. M., Germany

THE BASALT QUARRY and crushing plant at Sodenberg near Scheinfurt in northern Bavaria is one of the oldest and largest in southern Germany.

Sodenberg is a steep hill rising about 300 meters above the valley of the Saale in Franconia near the railway line running from Gemünden to Bad Kissingen. During the middle ages it was surmounted by a strong castle which, however, was destroyed during the wars of that period.

The quarrying and part of the crushing is carried on at the top of this hill and the partially finished material is taken down the side of the hill by aerial tramway to the finishing plant in the valley below.

The plant has a capacity of 80 to 90 metric tons* per hour and has been in continuous operation since 1904.

New equipment has been added and changes made from time to time so that the operation is quite modern.

Quarrying

The deposit is a clear pillar basalt with a crushing strength of about 3500 kilograms per sq. cm. or 49,700 lb. per sq. in.

The quarry is worked in five benches, each 15 to 20 meters high, on a face about 150 to 200 meters long. Two benches are worked above and two below the main working and haulage level. The overburden varies from 2 to 5 meters in thickness.

The structure of the rock is such that very little drilling and blasting is necessary, as the face can be easily broken loose by hand with an iron bar. However, an electric pneumatic jackhammer is used to some extent and about once a year a tunnel blast is made, particularly on the upper level.

The loading is done by hand, as is common in Germany, one of the advantages being that the rock is thus always clean and free of dirt or waste material.

Cars of $\frac{3}{4}$ -cubic meter capacity are used, which are moved over a track of 600 mm. gage. These are hauled on the main quarry level to the primary crushing plant by a chain tramway system. From the two upper levels the cars are lowered on inclined tracks to the main level and are raised in the same manner by hoists from the two lower levels. One hoist is driven by an

*Conversion table { 1 meter = 1000 mm. = 39.37 in.
1 metric ton = approx. 2200 lb.
1 kilogram = 2.2 lb.



Main quarry level

Our Author "Makes Good"

ONE DAY early in 1930 a modest and friendly visitor arrived at the editor's office. He was studying American quarry and crushing plants. It developed he was a university graduate and a doctor of engineering—also the owner of one of the oldest commercial crushed-stone operations in Europe.

As the annual convention of the National Crushed Stone Association (at Cincinnati, Ohio) was about due, Dr. Hans Leimbach was invited to be in on the party—and we believe he enjoyed himself and came to know some American quarry owners a little better.

When he departed for home to incorporate some of the results of his American visit in his own plant, we asked him to write about it. And he has. The editors hope that some of the friends he made at Cincinnati and during his visit to American plants will remember him and write him that they read his article. They will indeed find it interesting and instructive.—The Editors.

electric motor and the other by a Diesel engine.

Primary Crushing Plant

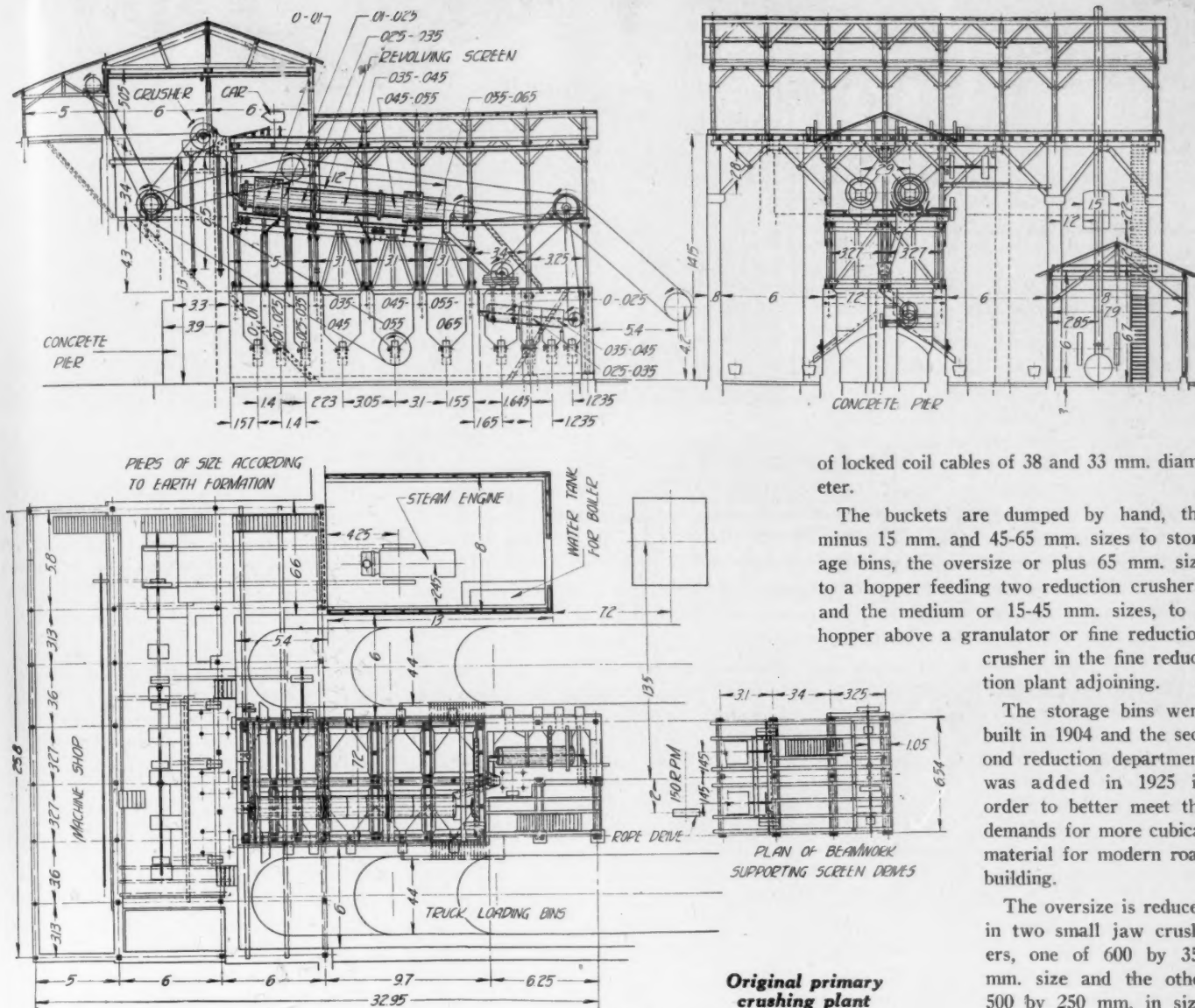
The original plant, which was built in 1904, is on the hill and it is here that the primary crushing is done. From this point the crushed material is moved by gravity down hill. However, this primary crushing plant has been changed somewhat as indicated by the illustrations on the page following.

Originally, the material from the primary crushers was divided to two long rotary screens which separated out the various sizes to bins below and from which the oversize was spouted to recrushers.

Later this was changed and now two shorter revolving screens are used to scalp the material from the primary crushers, followed by two recrushers, while the final separation is made in two longer revolving screens.

The cars from the quarry are dumped by hand into small hoppers ahead of each of the three primary jaw crushers. These are 650 by 400 mm. in size and are set for an opening of 130 mm.

From the crushers the material is divided to two rotary scalping screens 1.4 meters in diameter and 7.0 meters long. These separate out four sizes, 0-15 mm., 15-25 mm.,



of locked coil cables of 38 and 33 mm. diameter.

The buckets are dumped by hand, the minus 15 mm. and 45-65 mm. sizes to storage bins, the oversize or plus 65 mm. size to a hopper feeding two reduction crushers, and the medium or 15-45 mm. sizes, to a hopper above a granulator or fine reduction crusher in the fine reduction plant adjoining.

The storage bins were built in 1904 and the second reduction department was added in 1925 in order to better meet the demands for more cubical material for modern road building.

The oversize is reduced in two small jaw crushers, one of 600 by 350 mm. size and the other 500 by 250 mm. in size, both set for a discharge

25-45 mm. and 45-65 mm., which fall to silos below.

The oversize or plus 65 mm. material from these screens is spouted to two reduction jaw crushers. These are 700 by 400 mm. in size and are set for an opening of 80 mm.

From these two reduction crushers the

material passes through two long rotary screens (13 meters in diam. by 13.0 meters long), where the following sizes are separated out and fall to bins below; 0-5 mm., 5-15 mm., 15-25 mm., 25-35 mm., 35-45 mm., 45-55 mm., 55-65 mm. and plus 65 mm.

The stone from the primary crushing and screening plant is transported down the side of the hill to the storage bins and a second reduction plant by a Bleichert aerial tramway of the double-rope type. This tramway is 1200 meters long with a net vertical drop of 300 meters. It is provided with 60 buckets each of 400 kilograms capacity and is capable of handling 90 metric tons per hour. A 20 mm., long-lay, haulage rope is used and the track is made up

opening of 60 mm.

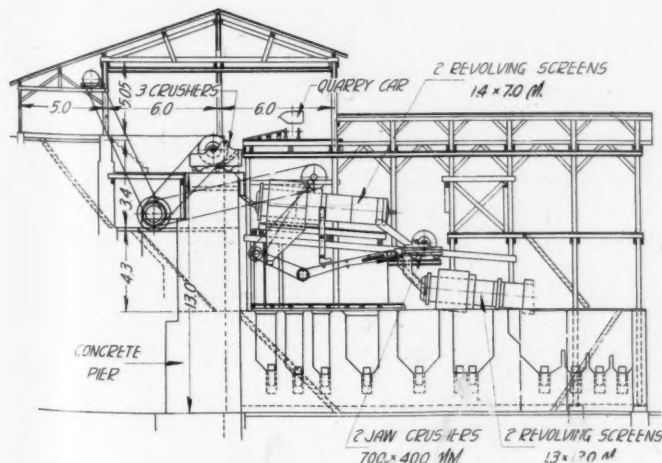
The recrushed material is carried up in a bucket elevator (15 meters long and with 500 mm. buckets) to a rotary screen 1300 mm. in diameter and 14 meters long. This screen also has two jackets and makes the same sizes as in the first reduction operation except that the pieces of stone are more cubical in shape.

The sized material falls from the screen to storage bins below, from which it is loaded direct to railway cars.

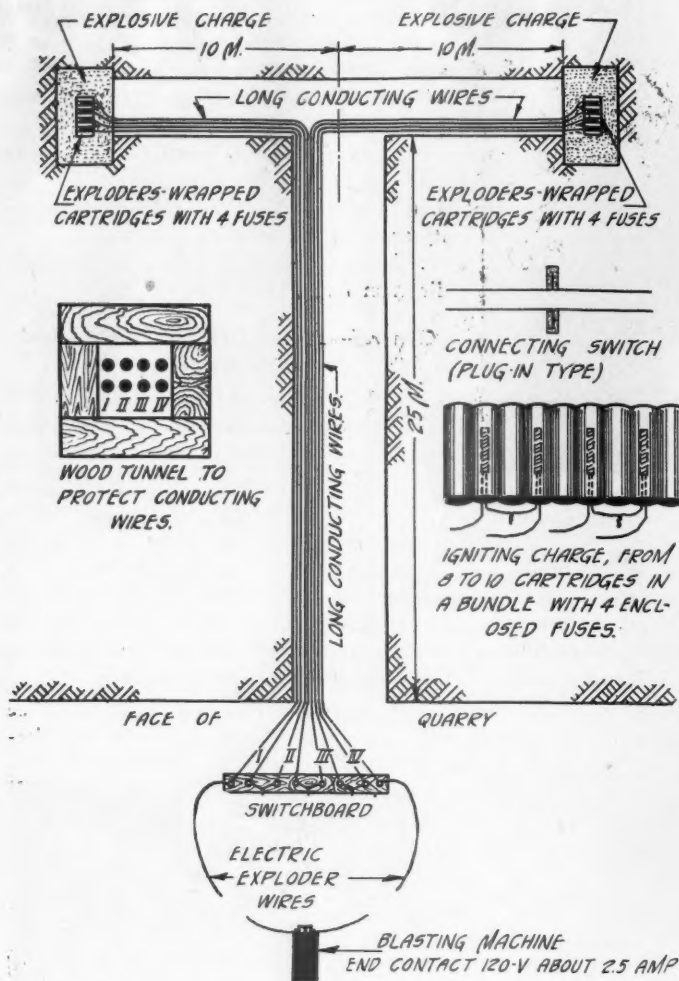
Fine Reduction Plant

In 1929-30 a fine reduction plant was added because of the demand for small cubical shaped stone for use as top dressing and with tar and asphalt.

This product is made by feeding the 5-35 mm. size stone to a granulator. The material passing through is carried up by a small bucket elevator (19 meters long and with 300 mm. buckets) to a vibrating screen (1.5 by 1.5 meters in size) for removal of the dust and finer material. The oversize from this screen then passes to a horizontal shak-



Revised screen arrangement in primary crushing plant



Method of electric firing

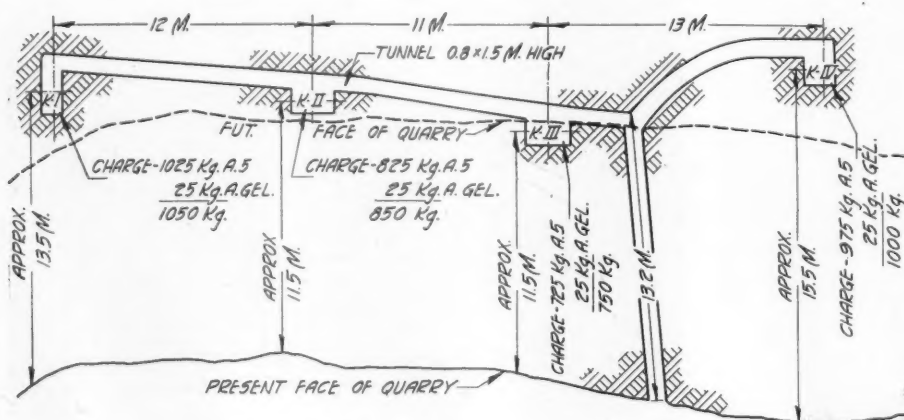
tric driven, the current being transformed down from 5000 volts to 380 volts for power and 220 volts for lights.

The crushers and granulator are driven by two 60-hp. motors, the shaking screen and elevator by a 25-hp. motor and the rotary screen and bucket elevator by a 20-hp. motor. A 14-hp. motor is used on the exhaust fan and 20-hp. and 15-hp. motors on the two car pullers.

The portable belt conveyor used in loading

from the outside storage piles is 15 meters long with a belt 500 mm. wide and is electric motor driven.

The product is used almost exclusively for road building, although a small part of the 45-70 mm. size is used for railway ballast. Most of the roads in this section are of macadam construction with a tar or asphalt top, concrete being very little used for this purpose. A total of about 130 men are employed at the plants.



Typical blasting diagram



End of chain tramway at old plant



After a shot

Report on Investigations in Rock Products Industry

IN THE INVESTIGATION of competitive conditions in the cement industry involving an inquiry as to whether activities of trade associations of manufacturers of cement or of dealers in cement constitute violations of the anti-trust laws, by the Federal Trade Commission, it reports that in addition to the field work, which is still in progress, questionnaire letters have been sent to manufacturers, state highway commissions, dealers, contractors, and ready-mixed concrete companies outlining certain information desired.

The commission's investigation of the building material industry is proceeding, the collection of data and development of facts being well under way, it reports.

The Commission in this inquiry will investigate and report facts relating to the letting of contracts for the construction of government buildings, particularly with a view of determining whether or not there are or have been any price fixing or other agreements, understandings, or combinations of interests under which such material will be furnished contractors or bidders for such construction work.

How to Balance the Corporation Budget?

IS MY COMPANY more resigned to current conditions than it should be? Could it make more? Could it lose less? Have we really done all that we should do to keep outgo within the confines of income or income greater than outgo? Have we been lacking in resourcefulness to create sales opportunities? Have we acted wisely in our curtailment of expense?

These are the kinds of questions that a bulletin recently issued by the accounting firm of Ernst & Ernst raises in the minds of executives.

Much is heard, the bulletin says, about balancing the governmental budgets, for the sake of protecting public credit and minimizing the increase of taxes. The merit of balancing government budgets is obvious, the accountants declare, and cannot be over-emphasized. But even stronger emphasis, it is suggested, could be put on the importance of balancing the budgets of every corporation, every business and every individual, for these are the foundation pillars of national credit and national prosperity, whereas government budgets are essentially superstructures.

Even in companies that still have ample reserves, there is, it is pointed out, the same practical necessity for control through a balanced budget that exists where cash has been seriously depleted over the past two years. "Every dollar of deficit in the cash budget represents a loss in working capital and thus a weakening of the corporation's long-time chance for success. Regardless of available reserves, an unbalanced budget represents a coasting, a drifting, and a loss of momentum which can be minimized and in some cases prevented through a balanced budget.

Two Ways to Balance Budget

"There are two general ways of balancing the budget. One is by increasing income and the other is by reducing expenditures. Both are equally important. In periods of depression an increase of income is usually difficult, because this depends on circumstances largely external, such as low demand, inactive markets, low prices and stiffer competition. The circumstances are not necessarily external, however. Under pressure of necessity many business managers have developed new products, new methods, improved quality. By using ingenuity they have sustained the income or lessened the shrinkage. One of the remarkable discoveries of the current business depression is that a large number of well-organized businesses are making satisfactory records, mainly because of their flexibility in turning to new plans and a controlled program of a balanced budget.

Cutting Expenses Is the More Common Method

"Cutting of expenses is the more common and general method of balancing a budget in times of stress. Ordinarily reduction of salaries and wages comes early in the pruning program, because this is a sure, definite, measurable and relatively easy recourse. Reduction of the wage roll may be either good or bad, depending on the intelligence with which it is done. One of the difficult things about employment of services is that they are not as definitely measurable in terms of value as are the products of services of machines. Wage and salary cutting should be done with unusual attention to a reappraisal of the value of services rendered. This checking is one of the best fruits of budget making and budget balancing. It often results not in a mere negative act of cutting the incomes of workers, but in a positive stimulation of them to give better services at a lower cost per unit of output.

"Reduction of advertising expenses is a common way of cutting expenses, because it seems easy. Here also a balance must be struck between temporary saving and long-range effect, and the latter should not be sacrificed except in cases of urgent necessity. Some managements have gone to the extreme in curtailing advertising without adequate reason, and they may be forced to pay heavily in future years for their panic now. A nice weighing of judgment is required.

Writing Down Assets Is Effective but Requires Courage

"The writing down of physical and other assets to represent true current value is one of the most difficult and courageous procedures in the whole field of budget balancing. Actually nothing is lost, but the looks of the thing are bad, for it may even turn a surplus into a deficit. It involves merely a recognition of the facts that former values are out of line with current values. Even the dismantling of unnecessary and unproductive portions of the plant sometimes represents a constructive step, for it reduces depreciation or depletion charges, and puts the concern in better position to push ahead either in depression or in future periods of revival. The rewriting of the balance sheet will sometimes accompany the establishing of a balanced budget.

Modernization

"Modernization of plant and equipment, the discarding of obsolete machinery or appliances, the spending of money for capital assets, may be one of the best ways of balancing a faulty budget. It takes courage, energy and foresight to spend vigorously in the present in order to save in the future.

But for some units and some industries it seems obviously imperative. Capital for the modernization of physical properties is not always available, particularly in times like these, but where the management is good and the benefits can be demonstrated through a budgeted program, capital is available in more cases than is commonly supposed, and this will be true to an increasing extent as the clouds lift. It seems clear that business development will be along lines of greater competition, of comparative efficiency of methods of production and distribution. One of the major factors in this contest for efficiency will lie in the efficiency of machines, and good managements will have good machines.

Selling Below Cost

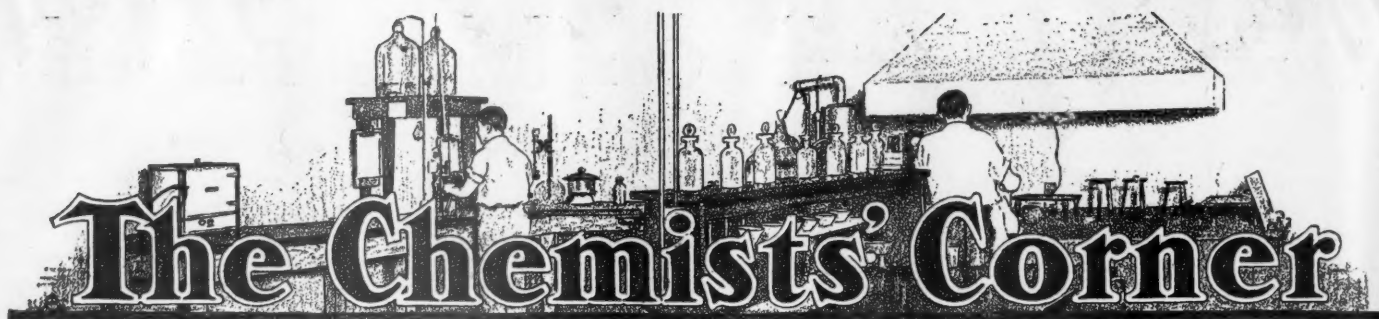
"Selling below cost in an effort to maintain volume of production is one of the common expedients during business depressions. Managements believe thereby they cut down their deficits. In a short range sense they may do so, but in the long pull they may actually create more loss, for by whatever margin below cost they sell, to this extent they dissipate their accumulated assets.

They put off the ordeal of adjustment and make the adjustment more severe when it finally comes. Furthermore they produce a competition which is as unfair to competitors as it is unwise for themselves. Competitors thereupon are encouraged into practices which react against the original seller-below-cost, and the vicious circle does no good to the business structure as a whole. Selling below cost may occasionally be required under peculiar circumstances, but it is essentially unsound, and it is a lazy way of tackling the problematical job of balancing the budget.

Dividend Policy Considered

"Dividends in times of stress sometimes exceed reasonable limits when they are paid though not earned. No flat rule can be laid down, but a general observation is that the payment of dividends during periods when cash outgo exceeds cash income often represents a dangerous practice. Some companies are justified by reason of their resources, and by the conservation of these in the past to prepare for emergencies.

"Business news these days has many bad-sounding features, such as reduction or passing of dividends, curtailment of operations, reduction of salaries and wages, continued economies, creditors' committees and receiverships. A point to be borne in mind is that many of these features are apt to have their obverse side which is constructive, for they may be in the interest of balancing the budgets."



Effect of Storage on Strength of Portland Cement

By L. R. Davies-Graham

Chief Chemist, Goliath Portland Cement Co., Ltd., Railton, Tasmania

I HAVE FOLLOWED with interest the discussion between Alton J. Blank and Katsuzo Koyanagi on the effect of storage on portland cement. *ROCK PRODUCTS*, August 15, 1931, page 62, had a further article by the former on this question, seeking an explanation of certain peculiarities. Without wishing to enter into any lengthy discussion, it is possible to submit certain figures for which an explanation can be offered.

A bulk sample of cement was taken and after thorough mixing was divided into three portions, as follows:

Sample No. 1 was spread on a mixing cloth in the laboratory, being thoroughly mixed every three days. The surface was waved so to expose a greater area to the atmosphere.

Sample No. 2 was placed on perforated trays and stored over a water bath. The trays were so constructed as to allow a circulation of air in the container, but the vessel was sealed against the atmosphere. These samples were also mixed every three days, as a thin crust was formed in this time.

Sample No. 3 was placed in an air-tight jar and was taken out and mixed as quickly as possible each time a batch of test pieces was made from it.

A small quantity was reserved to make an original test. Tensile tests by means of the Boehme hammer were carried out at each period, three blocks of each sample being broken at one time. A chemical analysis was made on the original sample, but unfortunately progressive analyses were not made, the effect on strength being the main consideration. The free lime was originally 1.4%, but had decreased to zero on all samples at the end of 35 days, this including the cement in sealed jars. The original loss on ignition was 1.0%, but at the completion of the series was 4.4% on the cement stored over water, 3.5% on that stored in air, and 1.2% on the bottle sample.

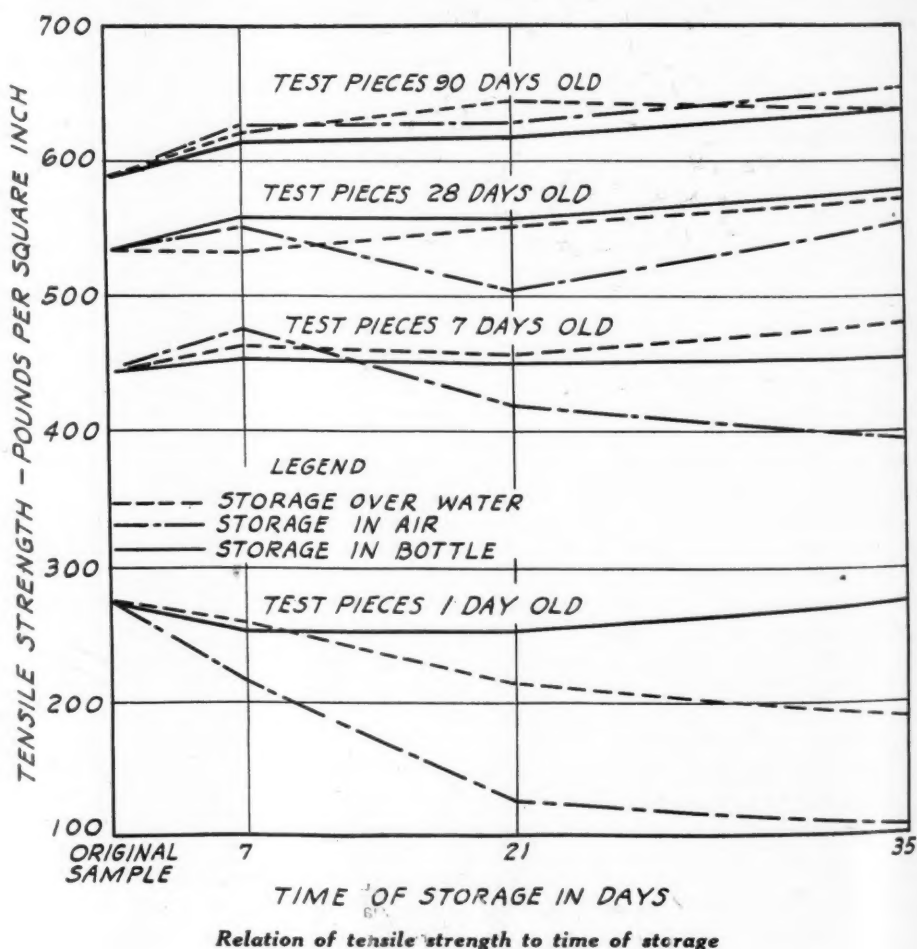
The individual test figures are given and to make the results more clear they have been graphed in two forms: i.e., (1) strength against time of storage and (2) strength against age of test piece.

The chief feature of Chart No. 1 is to show the decrease of 1 day strength with storage, though cement stored under more or less airtight conditions (Sample No. 3) shows very little decrease at this period

and ultimately an increase after 35 days storage.

On the same chart it is seen that at 7 days the sample stored in laboratory air shows first an increase and then a gradual decrease until after 35 days storage it has only 90% of the original strength.

Looking at Chart No. 2 we find that the sample stored in the bottle shows a gradual increase in strength, with the exception of



a slight falling off in 1 day strengths which might be considered within the range of experimental error.

The sample in laboratory air, Chart No. 2, shows first a falling off in 1 day strength after 7 days storage a falling off in 1, 7 and 28 days strength after 21 days storage, although after 35 days storage the decline in strength is confined to the 1 and 7 day periods.

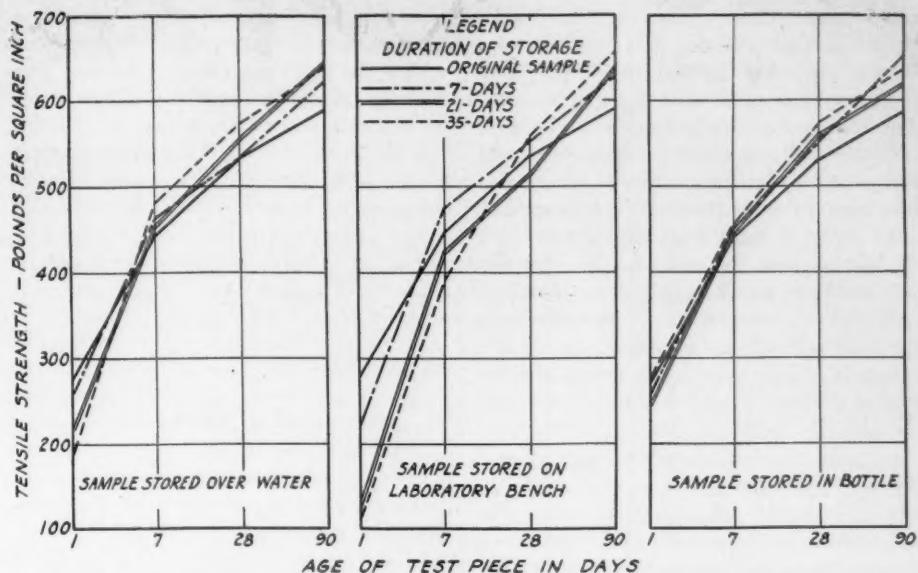
Sample No. 3 stored under moist conditions shows a gradual decline at 1 day, but a slight improvement at 7 days and a greater improvement at 28 days.

RESULTS OF TESTS (LB. PER SQ. IN.)

Sample	Age of test pieces			
	1 day	7 days	28 days	90 days
Original sample	274	444	532	564
	258	430	544	611
	290	458	530	595
Average	274	446	535	590
Stored over water 7 days	271	457	537	615
	245	481	540	619
	261	451	523	624
Average	259	463	535	622
Stored over water 21 days	219	452	549	651
	209	467	525	645
	211	454	583	645
Average	213	458	552	647
Stored over water 35 days	189	498	563	638
	189	464	568	638
	189	.....	591	645
Average	189	481	574	640
Stored on bench 7 days	216	505	537	630
	201	445	565	637
	240	477	551	620
Average	219	476	551	629
Stored on bench 21 days	129	407	498	632
	129	407	508	627
	123	447	516	.....
Average	127	420	507	630
Stored on bench 35 days	95	380	566	638
	119	398	566	661
	108	407	539	675
Average	107	395	557	658
Stored in bottle 7 days	275	440	551	648
	264	458	584	610
	236	472	536	599
Average	258	456	557	619
Stored in bottle 21 days	265	467	561	626
	241	454	555	596
	250	432	.....	639
Average	252	451	558	620
Stored in bottle 35 days	284	454	565	634
	266	444	594	652
	.....	460	575	639
Average	275	456	578	640

Conclusions

1 day strengths. One can quite imagine that atmospheric moisture would cause a decomposition of tricalcium silicate, which would cause a falling off in early strengths. The sample stored in an air tight bottle does not show any serious falling off in early period strengths.



Relation of tensile strength to time of storage under various conditions

7 day strengths. I leave this to somebody else to explain. The sample stored under air tight conditions might quite well increase at 7 days as the free lime decreased, but why the sample stored in laboratory air should show a decrease at this age, while that stored over water has a substantial progressive increase, is difficult to say. The entire explanation is no doubt to be fathomed in the CaO (free), H₂O, CO₂ system, but I am afraid that any explanation of mine would be too elaborate to be accepted.

28 day strengths. The general increase in 28 day strength is probably due to the

gradual decrease of free lime content. The original amount of free lime in this cement, namely, 1.4%, is certainly insufficient to cause any visible expansion, but it is equally certain that it causes what might be termed molecular expansion, which is sufficient to cause a retrogression in strength at 28 days.

90 day strengths. The remarks under 28 days might equally well apply to briquettes at this period, the exception being the laboratory air sample after 21 days storage, this sample being less than the original at 28 days. Perhaps it is the exception which proves the rule.

Notes on Analytical Procedure as Applied to the Cement Laboratory

By Donald C. Paquet
Seattle, Washington

THE RESULTS turned out by plant laboratories may, in the main, be divided into three general classes. The first group consists of the analysis of raw materials before processing, next comes the routine control of successive stages of plant manufacture, and, lastly, the analysis of the finished product. The analysis of raw materials necessarily requires a higher degree of precision than the others for the obvious reason that the proper calculation of mixes with the following correct resultant in finished product depends largely upon the results turned in by the chemist. The chemist who has the best interests of his employer at heart is endeavoring to accomplish several things with his work. His first consideration should be directed towards getting correct results within reasonable limits; secondly, the time consumed in making determinations is important, and, as applied more particularly to routine work, the cost

of the operation must be considered. No chemist who is honest with himself will admit that his technique is perfect or that he is not occasionally troubled with details of procedure which he is endeavoring to overcome. The notes herewith submitted comprise a few ideas which the analyst may find helpful towards the end of precision and speed.

The use of suction filtration, for example, is a means of speeding the average determination. This is particularly applicable to routine determinations where, as a rule, only one or two samples are carried along at the same time. In cases where more than three or four samples are run together no saving in time is secured over the ordinary filter, as proper manipulation of more than one suction set-up at a time is not possible. The suction filter, however, must be used with discretion. The proper filtration, by this means, of certain gelatinous precipitates be-

comes very difficult unless certain definite precautions are observed. The addition of a Fischer filtration accelerator or the same amount of macerated filter paper to the solution before precipitation will serve to prevent the precipitate from packing, providing a very gentle suction is used and the precipitate kept in suspension all the time with wash water. When the washing is completed the suction may be turned on full strength and the filter sucked nearly dry. The best type of suction apparatus for general use is the bell jar pattern in which the filtrate beaker is placed beneath the funnel and the solution filtered directly into the breaker for the next operation.

Analysts will find that the use of the smallest size porcelain casserole (No. 1) will speed up silica determinations on clinker and cement. These are about 1½-in. in diam. by ¾-in. deep. After weighing out the customary 0.5 gram sample it is moistened with just enough water to make a thin slurry and 1-2 c.c. of conc. HCl is added. The lumps are broken up with a short stirring rod and after about 15 minutes on the steam bath the solution is ready for the hot plate or oven for dehydration. This small size casserole is easier to clean out and serves to keep solution volumes down.

Several years ago this writer had occasion to make a large number of determinations of limestone. A 12-gal. carboy of ammonia was purchased and delivery was made from it by means of a siphon. After a short time it was noticed that the R_2O_3 group was gradually increasing in percentage and also assuming a decidedly light cast. Also the lime was dropping below what was expected. The trouble, of course, was that the ammonia stock was absorbing enough CO_2 from the air to precipitate part of the lime as carbonate along with the R_2O_3 . The difficulty was obviated by using perfectly fresh ammonia in the first place and, secondly, by adding it with a pipette to the boiling solution on the stove, to which had been added 1 c.c. of 0.2% methyl red solution. Ammonia is added only to the change from red to yellow. To the filtrate is added the necessary ammonium oxalate and the resulting precipitate of calcium oxalate is just dissolved with conc. HCl. To the solution is added a piece of filter paper about ½ in. square which is held down in the bottom of the flask or beaker with a stirring rod. This serves as a most efficient ebullator and the most voluminous precipitate will not settle and bump, provided the solution once starts to boil. After boiling commences in the clear solution, ammonia is slowly added from a pipette until the lime is precipitated and the solution turns yellow. By this means of precipitation there is absolutely no chance for calcium carbonate to form nor will there be any danger of losing the determination by reason of bumping or spattering.

The use of the dichromate method for

iron, using diphenylamine as an internal indicator, has come into decided prominence within the past few years. Opinions seem to vary principally as to the proper degree of concentration and condition of the final solution to be titrated. This writer had particular difficulty with the standardization, being unable to obtain satisfactory and consistent checks. After determining what seemed to be the best solution conditions for a sample of clinker, two 1 gram portions of any sample of clinker or cement were weighed out. To one of these the requisite amount of iron wire, ferrous ammonium sulphate or any other standardizing material was added. Both samples were then treated exactly alike and titrated with the dichromate to be standardized. Subtracting the c.c.s required by the sample of clinker alone from the total used by the other sample gives the number required by the standardizing material. From this number the dichromate value is calculated. In this way identical conditions are maintained and very exact checks are obtained. Needless to say, all subsequent determinations for iron in clinker or cement must be made in the same manner as was used for the blank sample.

The preliminary decomposition of clays requires, as a rule, fusion with sodium carbonate or other similar material. After making a large number of these fusions in platinum crucibles the writer had occasion to ignite one for weighing purposes. To his astonishment the apparently clean crucible developed a surprisingly large deposit of iron oxide on the inside of the crucible. Repeated treatment with HF, H_2SO_4 and HCl served to remove it. Referring to Bulletin No. 700, U. S. Geological Survey, we find that Hillebrand very definitely warns against this condition and offers as the reason that too often the analyst does not take the necessary precaution to maintain an oxidizing condition within the crucible during fusion, with the result that any reducible metals present may alloy with the platinum, in exceptional cases amounting to several milligrams in weight. This condition may be accumulative so that the apparently clean crucible may be far from it.

Masonry Cements

A STUDY of masonry cements and mortars has been undertaken at the Bureau of Standards. Certain hitherto unmeasured properties, such as plasticity, water-retaining capacity, and volume change, are being studied, and further workability, an essential property in masonry cementing materials, is being given particular attention. The compressive strength of 2-in. mortar cubes is also being determined.

Plasticity is measured in accordance with the principle employed in the McMichael viscosimeter—that is, shearing of the material by a fixed body in a rotated cup. The water-retaining capacity is measured by ex-

posing one side of a thin slab of the mortar to a slight vacuum for various periods of time. This simulates the water-withdrawing action or "suction" of a brick.

Volume change is measured from the time the mortar is mixed, through long storage periods when stored both at 60-70% relative humidity and inundated. Six specimens of the mortar are cast in a vertical manifold water-tight mold containing six 1-by-1-by-8-in. compartments with glass plates cast in each end of the specimen. Immediately after filling, the mold is placed under six dial strain gages—one gage for each specimen—by which the shrinkage is measured through the setting period. When the specimens have hardened sufficiently they are removed from the mold and placed in damp closet storage for one week after which they are subjected to the two storage conditions already described. Comparator measurements are made daily for the first week after removing from the molds, weekly for one month, and monthly from that time on. The cubes are made in three consistencies. They are stored one week curing in the damp closet, one week inundated, and finally one-half are placed in air at 60-70% relative humidity, the other half being kept under water. Cubes are broken at 7 and 28 days, 3 months, and 1 year after the date of making.

The study of the interesting property of volume-yield has been added to the investigation. This includes density determinations of the masonry cements, both dry and in the neat mix. Certain devices for the measurement of the above-mentioned properties have been developed during the investigation and they are now being used on some 40 or more masonry cements now on the market.—*Technical News Bulletin* of the U. S. Bureau of Standards.

A Novel Unemployment Relief Suggestion

IN A RECENT ISSUE of *Fusion Facts*, a publication of the Stoody Co., manufacturers of welding metals, Stoodite, borium, etc., W. F. Stoody of that company has written an interesting article and in it makes a very novel suggestion for the relief of unemployment. He starts his article with a discussion of the metric system of mensuration and compares it with our system and points out the great advantages that the metric system has. He believes that if everyone in the United States was to change from our system of mensuration to the metric system that ten million men would be employed a year by the various manufacturing companies, etc., in their reorganization necessary to make such a change. He believes that while this first cost might be considerable that in the end there would be a material saving and would also enhance our prospects of trade with other countries who use the metric system.

The Farm Market for Lime in Washington, Oregon and California

By H. A. Huschke

National Lime Association, Washington, D. C.

THAT there is a need for liming materials in the Pacific Coast states is shown by the fact that in 1930 the farmers of that section purchased 35,455 tons of liming materials. About one-fourth of this was burned and hydrated lime, about one-third was ground limestone and screenings and the balance was marl and by-product lime. California is the only one of the three states which compiles accurate consumption figures on liming materials, and the 1930 records for this state show a decrease of 28% in the tonnage used as compared with the previous year. Consequently, the above figure is probably lower than normal.

In the eastern states, where soil liming is generally practiced, the need for lime is aggravated by the generally acid condition of the soil. This condition does not exist to the same extent in Washington, Oregon and California. Rainfall is the one dominant factor which removes lime and other alkaline materials from the soil, thereby permitting the soil to become acid. Due to the fact that relatively small areas along the Pacific Coast enjoy sufficient rain to produce maximum crops without the aid of irrigation, it is logical that soil acidity is confined to these sections. Continued irrigation will in time affect the soil much the same as rainfall, and it is reasonable to assume that vast irrigated areas will be benefited by liming.

Acid Soil Areas

The areas where acid soils are most prevalent are as follows:

Washington—The counties of Whatcomb, Skagit, Snohomish, Kitsat, King, Mason, Thurston, Pierce, Lewis, Cowlitz and Clarke are located in the western part of the state where the rainfall is sufficient and acidity prevails. Acid soil is also found on the islands of the sound as well as some small areas in the eastern part of the state. A small amount of experimental work by the staff of the Washington State Experiment Station shows best results from lime in the southwestern counties. Clover and alfalfa grow well on the new soil but in a few years lime is needed.

Oregon—Acid soils are very common throughout western Oregon and especially so in the Willamette valley. The counties of Clatsop, Columbia, Tillamook, Washington, Multnomah, Clackamas, Marion, Yamhill, Polk, Lincoln, Benton, Linn, Lance, Douglas, Coos, Curry, Josephine and Jackson offer an immediate and receptive market for lime. Longtime experiments at the Corvallis and Astoria stations prove conclusively the necessity for lime and it is quite generally

recommended by agricultural workers in the above counties. As in Washington, clover and alfalfa may grow well for a few years on virgin soil but liming is soon necessary.

California—Here a peculiar condition exists in that the area of greatest rainfall and soil acidity is largely non-agricultural due to the rugged mountains. The counties of Del Norte, Humboldt, Mendocino, Lake, Sonoma, Marin and parts of San Mateo and Santa Cruz fall into this category. The delta area of the Sacramento river, being of muck or peat formation, is also very acid. On this delta soil truck crops thrive and liming is popular with a number of the large growers. Sections of the western foothills of the Sierra Nevada mountains are known to be acid, as are small isolated areas in the San Benito and Salinas river valleys.

Other Needs for Lime

Lime is not confined to the correction of soil acidity alone. As a matter of fact there are other uses, some in their infancy, which if properly developed are likely to present a far larger market. The following paragraphs are devoted to a brief resumé of these uses:

Improving the Tilth of Heavy Clays—Many acres of irrigated land are highly productive but due to the physical structure are difficult to cultivate. This type of soil, much of which is known as adobe clay, is greasy and sticky when wet and bakes into hard clods when dry. At times it becomes so sticky that it is virtually impossible to run a wheeled implement or wagon over it due to the amount of dirt which adheres to the wheels. Lime in the burned or hydrated form is effective in flocculating or drawing together into clusters the minute, colloidal particles which make up these soils. If the soil in question is planted to high value crops, such as citrus or other fruits, or truck crops, the benefits obtained from a loose, friable, more granular soil will pay dividends by lessening tillage costs and improving air and water circulation.

The problem of poor tilth is not confined to adobe soils or the irrigated sections of California. One outstanding possibility is the Palouse region in southeastern Washington. This famous wheat producing section is very rolling and hilly. The action of the weather and cultivation has removed the fertile topsoil from the hilltops leaving a heavy, unfertile, clay subsoil exposed. These comprise a large acreage. W. A. Rockie of the U. S. Department of Agriculture stationed at the state college at Pullman, is investigating this matter.

Lime for Plant Food—In spite of the fact

that much of the soil in Washington, Oregon and California is neutral or alkaline in reaction, there are cases where lime is either deficient or so tied up as to be unavailable to the plant. When the crop grown is one which consumes considerable lime, good results are often obtained when lime is applied. This is especially true in the case of citrus and some truck crops.

Apple Tree Protection—In certain apple growing sections and especially in the Hood river district young trees have suffered injury from extremes in weather conditions during the winter. The cause is due to active growth of the cambium layer (the growth layer under the bark) during mild sunny weather and the killing of these young growing cells by a quick, violent cold snap. It has been found that a fall coating of whitewash on the trunks and lower part of the main limbs prevents the absorption of heat during mild weather and protects against cold snap, should it occur. During the winter of 1928-29 an experiment showed the following results:

	Per cent. slightly to severely injured
Trees with no protection.....	79%
Trees with a board shield.....	22%
Trees with cold water paint.....	6%

The complete results of this work may be obtained by sending to the State Agricultural College, Corvallis, Ore., for Station Circular No. 103 entitled, "A Study of Tree Stocks in Relation to Winter Injury and Its Prevention."

Poultry Sanitation—Every industry has its troubles of one kind or another. The poultryman is no exception. Among other things he is continually battling disease and parasites. A number of practical poultrymen use hydrated lime as an important part of their sanitation program. The lime is spread freely on dropping boards, under the litter and generously applied in yards and runs. In this way the litter is kept dry and free from odor. Due to this clean and "sweet" condition less flies and bugs are attracted to the poultry house and, consequently, less insects are eaten by the chickens. Flies and other insects act as carriers of the worm eggs. If less are eaten the danger of infestation is decreased. The dryness created by lime tends to prevent the formation of germs.

Summary

From the above it will be seen that although the soil acidity problem is not as great on the Pacific Coast as it is in the eastern half of the United States, there is, nevertheless, a substantial and growing market for lime in agriculture. High freight rates and long hauls make the delivered price of such materials as ground limestone high when compared with the east. This condition should react in favor of the more highly concentrated burned and hydrated lime provided, of course, that the sale price at the farm is not proportionately higher than the carbonate forms.



Hints and Helps for Superintendents

Conveyor Guards

IN western Iowa and eastern Nebraska wind velocities are often so great that conveyor belts that operate in the open tend to flop around, lose their load and



Bar acts as a protection from wind

alignment and otherwise cause operating troubles.

To prevent winds from blowing the belt from the carrier rolls while standing still or even while operating, the L. G. Everist, Inc., Hawarden, Ia., has bolted $\frac{5}{8}$ -in. rods across the top of the open belt conveyors as shown in the illustration on every fourth carrier roll. This prevents the long belt from being carried off the rolls during these high wind periods.

Determination of Electricity Conductor Size

WHEN PLANNING new electrical haulage circuits or rehabilitating old systems, engineers and executives should determine whether the money for materials is over- or under-spent. To determine the wisdom of

expenditures, Kelvin's "Law of Electric Economies," should be used. This law reads: "The most economical section for a conductor is that which makes the annual cost of power losses equal to annual interest on the capital cost of the conductor material plus necessary annual allowance for depreciation." How this law can be applied in practice is described in a recent issue of *O-B Haulageways*.

Yearly cost of operating a mine circuit, including overhead and track circuits, consists of charges for line losses, interest, and depreciation. If the conductivity of the circuit is inadequate, line losses become high and power cost at the switchboard is excessive. On the other hand, if the overhead system is built with too much copper, the rails are too heavy, and the joints overbonded, interest and depreciation charges become excessive. Therefore, a balance should be struck between the cost of line losses and the yearly fixed charges.

Care should be exercised in locating the cause of waste before corrective measures are applied. Mistaken attempts to overcome inadequate bonding by increasing the capacity of overhead circuits are not uncommon, despite the fact that overhead construction is more expensive and more difficult to maintain than the track circuit. In this case, the selection of a bond with less resistance is all that is required. On the other hand, the mistake sometimes is made of increasing the bonding capacity when the trolley and feeder system only needs additional capacity.

An illustration of how these mistakes can be made is presented in the accompanying chart. This predicts the power losses and savings of bonds of varying capacities on a 1000-ft. section of track equipped with 40-lb. rail and a total of 96 bonds. It was shown in a recent issue of *Coal Age*. It is assumed that the entry is working 300 days per year, each of eight hours, and the power

cost is 3c. per kw.-hr., the load being 500 amp.

Using the 2-0 bond as an index, this chart shows that although the 4-0 bond costs more initially, it reduces the power losses per year and effects a saving over the 2-0 bond. The 500,000 circ. mil. bond is the opposite extreme and actually shows a loss due to overbonding. Between these two extremes a middle ground can be established.

Welding Puts Hammer Mill in Operation in Three Days

THE ECONOMIES that result from the use of the oxy-acetylene process in repairing large castings were recently demonstrated at a rock products company in the Middle West, a recent issue of *Oxy-Acetylene Tips* states.

The continuous vibration and stress incident to the operation of a large rock crushing hammer mill caused the side frame of the mill to crack, and before it was noticed a whole section of the frame broke loose. It was not possible, of course, to keep the mill in operation, and, as it was one unit of a continuous series of various sized crushers and screens, it was imperative that it be repaired as rapidly as possible.

An inquiry quickly brought out the fact



The welded side frame

Size of Bond	Relative Cost of Bonds	500 Amp. Load	
		Power Loss per Year	Saving over 2-0 Size
2/0	■ \$33.00	■ \$17.25	
4/0	■ \$39.60	■ \$13.36	■ \$1.78
500,000 CM.	■ \$72.00	■ \$8.21	■ Loss \$4.34

Cost data chart



Section of broken frame

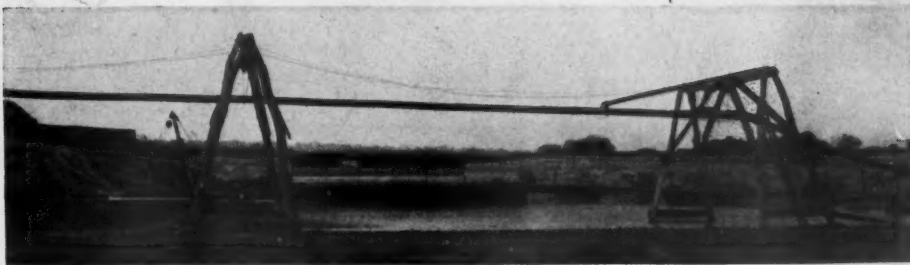
that a new side frame not only would cost about \$1500, but would take several weeks to deliver. An oxy-acetylene service operator assured them that the mill frame could be rapidly and economically repaired by bronze-welding, which would make it unnecessary even to dismantle the frame from the rest of the mill.

Accordingly, under his direction the broken edges were chipped off to form a bevel, and the broken section was clamped in correct position and alignment by means of U-bolts. Because of the location of the fracture and because bronze welding rod was to be used, extensive preheating was not required and the casting was soon ready for welding. Two welders worked together, using high-strength bronze welding rod.

The total cost of the work was only about 13% of the cost of a new side frame casting and the machine was in operation again in less than three days.

Drag Scraper for Surge Bins

THE DISTRICT some 20 to 25 miles south of Alexandria, La., is a prolific producer of sand and gravel. The largest operation in the district is the Gifford-Hill and Co. plant at Forest Hill. This company has two 10-in. Bennett and one 12-in. Amsco equipped suction pump



Pipe line is carried on simple "A" frames

dredges that deliver to temporary de-sanding plants. The gravel from these small plants falls to standard gage gondolas and is hauled to the gravel washing plant, permanently located near the pit. With upwards of 100 cars of gravel per shift, to say nothing of the sand being shipped, something in the way of storage facilities must be provided between the final washing plant and the pit-to-plant transportation system.

The method of operating is as follows: the cars from the various de-sanding plants are spotted on an elevated structure near the plant and dumped. A 3-yd. Sauerman Crescent scraper then drags the material to a hopper that serves a sorting belt from which any clay balls or other debris are removed by hand, after which the gravels are elevated, by a belt conveyor, to the Link-Belt conical washing screens for final washing and classification.

By the use of the drag scraper a storage space is provided that in essence serves the purpose of a surge bin between the pit and the plant. Naturally it functions to help eliminate unnecessary inter-plant delays.

Reducing Friction in Dredge Pipe Line

AS we have preached before, the most efficient sand and gravel pumping operations are those that reduce the total lift to a minimum and eliminate as many of the elbows as possible. Well, says a producer, "How are you going to get a pipe line up a 30-ft. bank without two elbows?" The accompanying view, taken

at the plant of the Ottumwa Sand Co., Ottumwa, Ia., gives one clew as to how this can be accomplished, namely, by suspending the pipeline from A-frames, gradually increasing their height as they approach the bank instead of introducing two costly, friction producing elbows to pump against.

Mine Safety Precaution

AT THE Pixley, Mo., quarry of the Stewart Sand and Material Co., Kansas City, Mo., the stone is recovered from a practically horizontal vein by the room-and-pillar method of mining. Trucks are used for transporting the stone to the primary crusher. To protect the truck drivers from any falling stone the entrance to the mine is protected by a collar of light lumber built in such a manner that any small stones or other debris that slips off the face over the top of the adit does not endanger the lives of the truck drivers.



Scraper serves a sorting belt



Loose rock cannot strike workmen entering tunnel

Foreign Abstracts and Patent Review

A Review of Clinker Cooler Designs. Erich Schirm describes briefly the various designs of clinker coolers in order to assist manufacturers and plant managers in the selection of a desirable type of cooler. The waste heat obtained from the clinker is con-

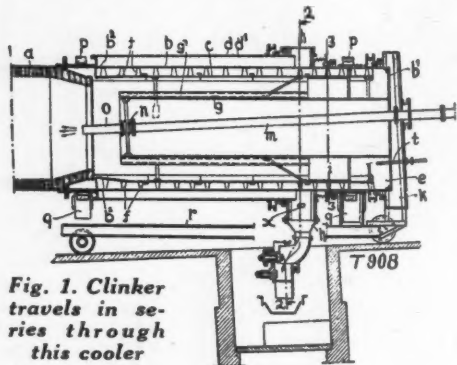


Fig. 1. Clinker travels in series through this cooler

sidered primarily for use in preheating the combustion air supplied the kiln. Clinker coolers heat the combustion air either directly or indirectly. Coolers may be classified also as drum, shaft, grate or coil coolers. They may be classified also according to their use in shaft kiln, rotary kiln or other types of kiln plants.

The principal disadvantage of the drum cooler is that it impairs the observation of the burning zone of the rotary kiln, especially if it is provided with a trickling arrangement. It is also not practicable to build the cooler long enough to remove all the heat from the clinker. Fig. 1 is an example of a method suggested to avoid this disadvantage. The cooler is connected to the kiln by means of a flange so that it can be removed easily in case of trouble, it being placed on trucks. The cooler consists of three drums located in equiaxial position, through which the clinker travels in series, first forward between the inner two drums and then back between the outer two drums. But little heat is lost by radiation. A kiln observation tube is provided at the

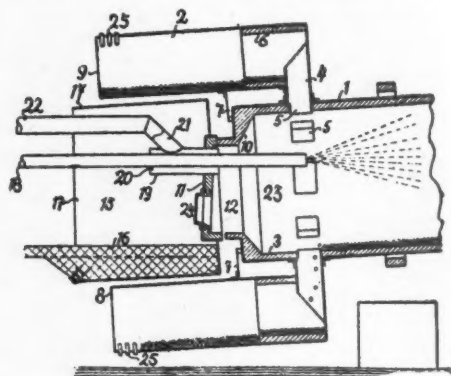


Fig. 2. Drum cooler with individual tubes on periphery of kiln

center of this comparatively short cooler. The air is in intimate contact with the clinker. There is danger that large clinker pieces clog in the narrow passage between the equiaxially located drums. Therefore a crusher or grinder is placed at the lower end of the inner drum. A screen at the mill outlet prevents the passage of larger clinker pieces into the outer drum. The air supply duct is provided with a damper.

A short cooler with a clinker-free observation tube in the center is available also in the cell cooler, in which the cells are arranged in a circle on the periphery of the cooling drum. Several circles of cells may be arranged equiaxially, through which the clinker is then passed in series.

A further development is the drum cooler, which is divided into individual cooling tubes. An example is the so-called rim cooler shown in Fig. 2, in which the individual tubes are installed on the periphery of the burning drum. The rotary kiln is connected to each one of the cooling tubes,

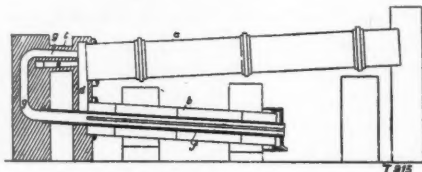


Fig. 3. Tube through center of cooler provides dust free air

which are charged as they pass at the lowest position on the kiln periphery by a special socket. The ring cooler requires considerable space and there is a tendency of the air to pass upwards into the upper tubes, causing heat loss. Another disadvantage of direct heating of the air is that dust is carried along with the air from the cooler, which is true also of drum coolers, thus impairing observation of the kiln fire.

Indirect heating of the air is therefore preferred, especially for securing dust-free primary air as in the design shown in Fig. 3, in which the air passes through tubes centrally located in the cooling drum, the heat being transmitted by direct contact of the clinker with the tubes. Secondary air may be heated by passing it direct through the drum. A larger cooling area is required with the indirect heating method. The arrangement of the clinker cooler requires a greater kiln plant height, but the cooler may be driven independently of the kiln, permitting any desir-

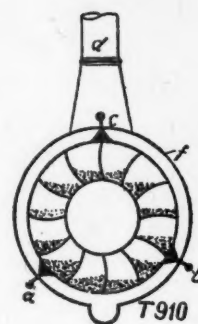


Fig. 4. Water sprays cool the exterior of the drum

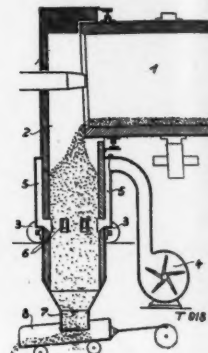


Fig. 6. Shaft cooler with air jacket

able speed and diameter of the cooler.

If the kiln is supplied with air heated by the waste kiln gases, water instead of air may be used as the cooling agent in the clinker cooler. A clinker cooler for heating water is shown in Fig. 4, which is of the cell design, in which a drum is divided into a number of cells through which the clinker is passed. The water is admitted from a nozzle at the top and flows down both sides of the drum. A couple of water nozzles are provided in the lower part of the drum to assure water requirements for the entire cycle. Steam discharges at the top and the water at the bottom of the surrounding housing. Cooling with water is more effective than cooling with air. It is desirable to cool the clinker first with air and then subject it to a secondary cooling with water.

Fig. 5 shows a drum cooler in which the clinker heat is transmitted indirectly to the air. It consists of two equiaxially located horizontal drums, which are rigidly connected and rotated in common. The clinker passes in the inner drum from left to right, while the raw material to be heated passes in the outer drum from right to left, the counterflow principle resulting in a higher temperature. In another type of clinker cooler the raw material to be heated is mixed with coarse clinker and at the other end of the cooler separated again by suitable screens, for which purpose raw cement

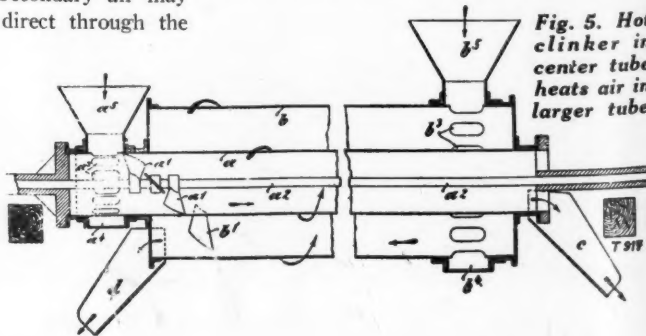
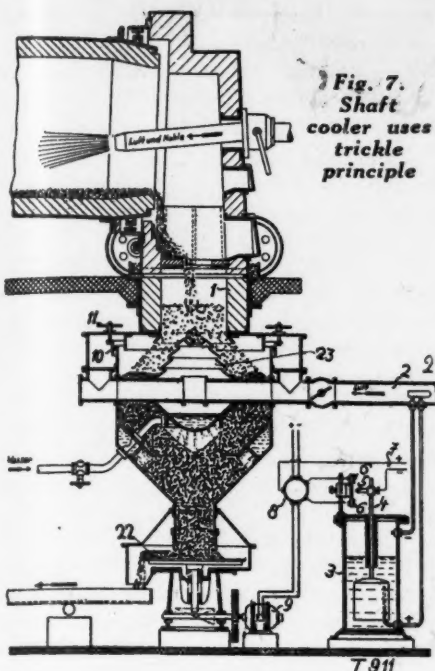


Fig. 5. Hot clinker in center tube heats air in larger tube



slurry is suitable, the clinker heat being used to evaporate the slurry water. (Fig. 6.)

A simple smooth shaft cooler is mounted on wheels and combined with the burner end of the rotary kiln. The cooling air is admitted at medium height so that it cannot travel downward. This cooler requires hardly any additional floor space, but it requires a higher elevation of the rotary kiln.

Fig. 7 shows a shaft cooler with a trickling device. A lower air pressure is required than in the smooth shaft clinker cooler, since this cooler is not as high. The clinker pieces change their position constantly and the cooling air strikes them uniformly on all sides. The shaft is fixed, while the kiln hood is movable to permit access. The cooling air enters partly through the mushroom grate and partly through an annular slit, the air entering from above to effect quick cooling. A water spray is provided further down which serves as an air lock. In order to maintain an even air pressure in relation to the column of clinker, a regulator is provided that controls the drive of the discharging pan so that during an increase in air pressure in the air feed line, as a result of an increase in the column of clinker, the speed of the discharging pan drive is increased.

In Fig. 8 is shown a plate shaft clinker

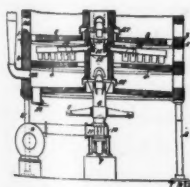


Fig. 8. Cooler with multiple hearths (upper right)

Fig. 9. An application of the shaft cooler

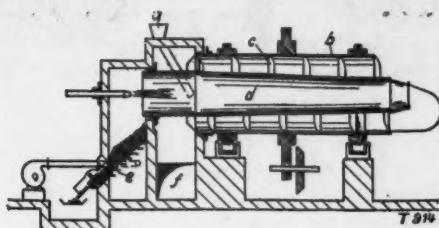
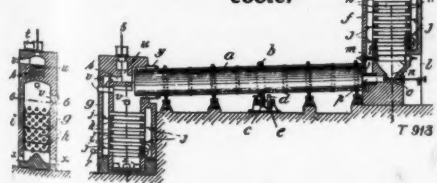
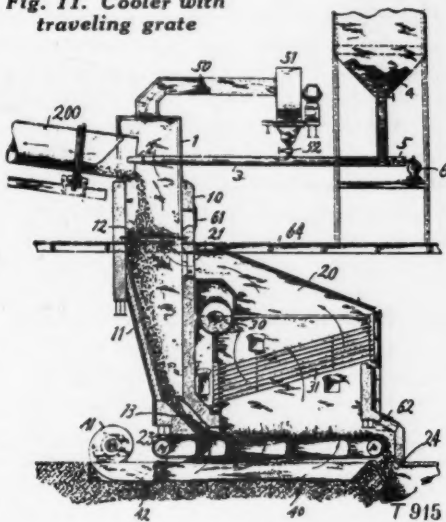


Fig. 10. This cooler uses a stair-step grate

cooler in which the clinker travels over several plates located one above the other, which design has been introduced into the cement industry in America. The clinker is continually moved about by cooled scrapers rotated about the center, and at the same time it is conveyed forward. This arrangement is not considered satisfactory, as it is involved and must operate at low temperature differences, giving but a small increase in kiln efficiency.

The shaft coolers so far described operate with direct air cooling of the clinker. Fig. 9 shows a shaft cooler designed for indirect heating of the air, which is provided with a large number of horizontal and parallel angle irons with the open face downward,

Fig. 11. Cooler with traveling grate



over which the clinker travels while the air passes below them, an air chamber being provided at each end. There is but a small increase in air temperature. In order to obtain a strictly indirect cooling method, the angle irons may be replaced with pipes through which the air is passed. Clogging of the clinker is possible if the angle iron or pipe is placed too close together, unless a screen is installed between the kiln and cooler. Water cooling may easily be added. This installation also has a preheater in front of the rotary kiln, constructed similar to the clinker cooler.

A simple design of cooler with stair-step grate is shown in Fig. 10, in which the clinker travels in a uniform layer down the grate steps, while the air is forced by a blower beneath the grate steps. The clinker is cooled rapidly and effectively and the air resistance is low. The top part of the layer

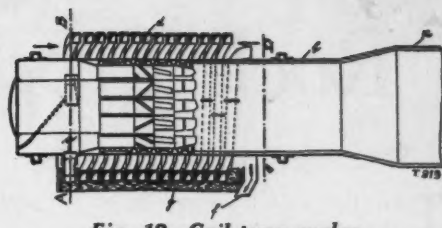


Fig. 12. Coil type cooler

of clinker travels faster, which is a disadvantage, for while it protects the grate from contact with the fresh hot clinker it results in irregular cooling. This could be overcome by using a sliding grate or shaking grate with special drive.

A clinker cooler with traveling grate is shown in Fig. 11. This type of cooler assures a uniformly heavy layer of clinker, thus effecting a uniform cooling and preheating of the air. The clinker heat is used to generate steam in an inclined tube boiler above the traveling grate. Grate bars are provided between the rotary kiln and clinker cooler, which allow the fine clinker to fall through. The air is heated at the traveling grate and, after then being cooled off in striking the boiler tubes, enters beneath the grate bars, where it is heated by the larger clinker pieces and passes into the kiln. The production of steam or hot water in the clinker cooler is justified only in special cases where a greater air volume must be passed through the cooler than can be used in the kiln.

The coil type clinker cooler is primarily designed as a direct heating cooler. In Fig. 12, parallel pipe coils are placed around the rotary kiln end, into which the clinker is delivered after having passed through a crusher. At the bottom the coils are immersed in a water tank provided with an overflow, sufficient water being supplied to maintain an overflow. This short, compact arrangement gives all the advantages of a short drum cooler connected directly to the rotary kiln end. Visibility of the burning zone of the kiln is but slightly impaired and no special drive is needed. The air passes at a high velocity through the narrow cooling tubes, and there is a long period of contact with the clinker in spite of the short dimension of the plant. A disadvantage is that the coils may be easily clogged with clinker. From this review it is apparent that there are many designs of clinker coolers to meet special requirements.—*Tonindustrie-Zeitung* (1930) 54, nos. 96, 97, 98.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Commissioner of Patents, Washington, D. C., for each patent desired.

Process for the Recovery of Phosphate Fines. The "process" covered by this patent is only drying the sludge from washing phosphate rock and screening the dried material over a fine screen, 40 mesh, being one size mentioned. Sun drying and drying by artificial heat are both covered.—*Philip McG. Shuey and Erwin Woodward, U. S. Patent 1,810,794.*

Rock Products Clinic

Wisconsin Aggregates Case

THE EDITOR: Referring to the editorial in *ROCK PRODUCTS*, December 5, 1931, commenting on the decision of the Department of Agriculture and Markets, state of Wisconsin, in the case of the alleged unfair competitive methods employed by sand, gravel and crushed stone producers: We are very glad to have you take this position. The department would have gladly assisted the sand and gravel industry by issuing an order if they felt that it could be enforced, but it would be foolish to issue an order that could easily be upset if appeal was made to the courts.

R. M. ORCHARD, Counsel,
Department of Agriculture and Markets.

* * * * *

THE EDITOR: The writer has read with unusual interest your report of the hearing in Milwaukee of the case of the State of Wisconsin, Department of Agriculture and Markets, plaintiff, vs. Sand, Gravel and Stone Cooperative Association, defendant, as given in September 26 issue of *ROCK PRODUCTS* under the title, "Can the State Compel Producers to Earn a Profit?" and in the October 10 issue under "Cost of Motor Truck Hauling of Sand and Gravel."

The situation of the gravel and stone producers in the Milwaukee district is so typical of all nonmetallic mineral enterprises in the United States that it illustrates others.

The following comment is made in answer to your request for reactions of readers "as to the feasibility or desirability of state or federal government control" of the industry.

Feasibility must first be predicated upon constitutional rights. In a decision by the United States Circuit Court of Appeal, of the Tenth Circuit, sitting in Denver, Colo., the court declared that: "While there is no such thing as absolute freedom to engage in a lawful business, to make lawful use of his property, or to contract with respect thereto, and such rights are subject to a great variety of restraint, freedom in respect thereto is the general rule and restraint thereof the exception; and the exercise of legislative authority to abridge such rights can be justified only by the existence of exceptional circumstances." The court was discussing the statutes referred to in the first paragraph of your September 26 article, enacted by the legislature of the state of Oklahoma in 1925, providing for the licensing and the practical limitation of the number of ice manufacturers within the state.

Citing several authorities, the court said: "It is settled by recent decisions of this court that a state legislature is without constitutional power to fix prices at which commodities may be sold, service rendered or property used, unless the business or property

involved is 'affected with public interest.'

... That phrase, however it may be characterized, has become the established test by which the legislative power to fix prices of commodities, use of property or services must be measured. As applied in particular instances, its meaning may be considered, both from an affirmative and a negative point of view. Affirmatively, it means that a business or property, in order to be affected with a public interest, must be such or be so employed as to justify the conclusion that it has been devoted to a public use and its use thereby in effect granted to the public. Negatively, it does not mean that a business is affected with a public interest merely because it is large or because the public are warranted in having a feeling of concern in respect to its maintenance.

"Nor is the interest meant such as arises from the mere fact that the public derives benefit, accommodation, ease or enjoyment from the existence or operation of the business; . . . and on the abuses reasonably to be feared. To say that a business is clothed with a public interest is not to import that the public may take over its entire management and run it at the expense of the owner. The extent to which regulation may reasonably go varies with different kinds of business. The regulation of rates to avoid monopoly is one thing. The regulation of wages is another. A business may be of such a character that only the first is permissible, while another may involve such a possible danger of monopoly on the one hand, and such disaster from stoppage on the other, that both come within the public concern and the power of regulation."

"A state may not, under the guise of protecting the public, arbitrarily prohibit a person from engaging in a lawful, private business, or impose unreasonable and unnecessary restrictions upon such a business." (Citing *Liggett Co. vs. Baldrige* 278 U. S., 105-113, and other cases.)

The court held that statute to be void, because violative of the Fourteenth Amendment of the Constitution of the United States in that it constituted an unwarranted interference with the freedom of persons to engage in a lawful business by providing for the limitation of the number of persons who may engage in such business. (*Southwest Utility Ice Co. vs. Liebmann*, C. C. A., Tenth District, August 20, 1931.)

To the writer at least, these citations indicate quite clearly that the Wisconsin law is unconstitutional, explaining at the same time why similar legislation applied to railroads and public utilities is constitutional because they are "affected with public interest" to an extent to which the nonmetallic industry is in no way comparable.

Therefore, state or federal regulation of a

business other than one definitely "devoted to a public use" is only feasible providing the Fourteenth Amendment of the Constitution of the United States may be repealed or more liberally interpreted.

As to the desirability of such control, little needs to be said. There is a fairly general agreement that control has been overdone in the case of railroads and utilities. Perhaps a step can be made in the right direction by amending the Sherman and Clayton acts of the anti-trust laws to the extent that trade associations can set up stronger organizations for their own government.

Your articles depict the failure of the Wisconsin association at a time when it should have been of most value to its members. This has been the experience of most trade associations. They need a George Washington to bring them through a Valley Forge.

My conclusion is a corollary to this last statement. The trade associations can weather the storm without state or federal control by building up in prosperous times an organization under a dictator-manager with power and ability to hold them through the depressions.

B. C. BURGESS, Manager,
Tennessee Mineral Products Corp.,
Spruce Pine, N. C.

Standardizing Testing Sieves

THE EDITOR: I note on page 59 of the May 9, 1931, issue of *ROCK PRODUCTS*, in Edmund Shaw's article, "Sieve Testing of Aggregates," he says, "one error noted in two charts was that of giving different widths of opening to the Tyler No. 48 sieve and the U. S. Standard No. 50 sieve, although the two are the same." I wish to explain that this chart was made before the A. S. T. M. reconciled the difference. My original data showed the No. 50 had a width of mesh of 0.0110 in. while the No. 48 had a width of 0.0116 in.

Mr. Shaw has given this subject a very thorough study. The chart he recommends is splendid so far as it goes, but I would extend it to a 200-mesh or even farther.

My chart, like many others, was designed to meet a need. Before the present highly-developed state highway laboratories were created, there existed a large number of laboratories in every state belonging to small municipalities, each using a different set of screens and sieves. A producer who furnished materials for more than one of these municipalities found it necessary to submit a screen analysis through a variety of screens and sieves. The writer devised this diagram for the purpose of interpolating from one screen system to another so that one test or analysis would serve several customers. It has an additional value in showing graphically at a glance what otherwise would take considerable time to read in a table.

R. C. YEOMAN,
Assistant to President,
Construction Materials Corp.

Chicago, Ill.

Editorial Comment

Are minds and energies of some producers so occupied with present problems of making both ends meet that nothing is left for making plans for future profit? If that is the case those producers' minds and energies are being wasted in a fruitless effort to survive, without really knowing why they want to survive, as well as how they are going to survive.

What plans are they making to provide for markets that are certain to come? What are those markets going to demand? What factors are new? What must be done to meet them? And how much longer can one wait? For every one knows that a purely waiting, defensive policy in business never spells success in the long run, certainly not in a country of go-getters such as ours.

Suppose we start with a few general assumptions that seem reasonably correct: (1) Home building and commercial building will be the first to recover; (2) highway and public works construction will be at low ebb for a considerable period during financial readjustments; (3) prices will continue at low levels; (4) transportation costs are and will continue at high levels, and will continue to be a most important factor in delivered price; (5) new capital will command high prices. We might go on, but these are sufficient to provoke real thought about the future of any rock products enterprise.

Sewell L. Avery, president of U. S. Gypsum Co., in a recent address before the Illinois Lumber and Material Dealers' Association, said that in the future homes will be bought by specification, from dealers who will not only furnish materials, but will also arrange all details, including financing and service. In this respect, future home buying will be similar to purchasing an automobile from a dealer who sells by specification and arranges everything for the buyer, including service and financing, he said. An advertising campaign to bring dealers together into larger units has been started by this company.

While unit home selling by the mail order houses forms an improvement over former methods, the material business men are in a better position to combine with their material business the details of construction, financing and service which are not now available on a unified basis to any large extent, Mr. Avery said. In his estimation, the major accomplishment of the mail order houses in this industry was development of a finance plan.

To carry out such large scale operations, Mr. Avery indicated that it would be necessary for the small building dealers to get together and form large enough companies to economically handle the situation. In addition to making arrangements for the building of homes, these companies would supply the designs as well as plumbing, fixtures and furnishings.

Are other gypsum products manufacturers, and portland cement and lime manufacturers thinking in terms of unit house selling? Are they individually or collectively thinking in terms of acceptance corporations that on a large scale will finance such houses? Have they worked out designs and plans that insure the use of their products? The chances are that homes of the future will be vastly different from those of today. They will be fireproof, or at least fire-resistant; they will be insulated against heat and cold; they will probably be tornado proof and earthquake proof in localities where such catastrophes are probable or possible. Obviously the signs point to a greatly increased use of rock products, if rock products manufacturers are alive to their opportunities.

In the matter of price and low costs, are rock products manufacturers visualizing the present opportunities to put their plants in shape to meet future demands? Or are they marking time, using up high cost inventories of repair parts, patching and mending obsolete equipment? Are they writing down their investments to present worth, making adequate charge-offs for depletion and depreciation; or are they kidding themselves that by some happy circumstance 1929 prices and values will soon be restored and everything will be lovely and plain sailing? Maybe so, but if and when this occurs they should not forget that prices of machinery and equipment will also go up and they will be faced with a demand for heavy purchases at increased prices, with probably high-priced capital.

Those who pin all their faith to the future development of public works and highways face a still greater and more general problem, for they must jump in now and give their help to untangle public financial problems; must help to prevent gasoline tax diversion; must help to restore public confidence in the solvency of public works authorities. There is no question of the future need for more and better highways, grade crossing eliminations, street pavements and public works generally, but obviously all whose interests are at stake must help the public to see the need and help to finance them on a sound basis. There is an opportunity now as never before to insist on business in government, not government in business.

The future of this industry and of almost every other industry for that matter will depend more than ever before on the breadth of outlook and business capacity of producers, both individually and collectively. Prior to the recent depression it seemed as if business and industry was rapidly approaching its problems in a large way. Stress of the times has caused many individuals to revert to barbarous business practices. Nevertheless enough individuals will survive, who remember better ways, to form the nucleus of the bigger and better business organization which will come. Do you aim to be one of these?

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend	Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's ²⁷	3- 9-32	94			Marbelite Corp. com. ²⁵				
Alpha P. C. com. ²	3- 5-32	8½	9½	25c qu. Jan. 25	(cement products)	3- 3-32		75c	
Alpha P. C. pfd. ²	3- 5-32	80	90	1.75 qu. Mar. 15	Marbelite Corp. pfd. ²⁵	3- 3-32	1		
Amalgamated Phosphate					Marquette Cem. Mfg. 1st 5's,				
Co. 6's, 1936 ¹⁹	3- 4-32	80	90		1936 ¹⁹	3- 9-32	80		
American Aggregates com. ¹⁰	3- 4-32	2	4		Marquette Cem. Mfg. 1st 6's,				
American Aggregates pfd. ¹⁰	3- 4-32	10	15	1.75 qu. Jan. 1	1936 ¹⁹	3- 9-32	85		
Amer. Aggr. 6's, w.w. ¹⁰	3- 4-32	25	35		Material Service Corp.	3- 8-32	13	13¾	
Amer. Aggr. 6's, ex.w. ¹⁰	3- 4-32	23	33		McCrary-Rodgers 7% pfd. ²²	3- 3-32	40	45	87½c qu. Dec. 30, 1931
Amer. L. & S. 1st 7's ²⁷	3- 9-32	71	75						
American Silica Corp. 6½'s ³⁸	3- 9-32	No market			McCrary-Rodgers com. ²²	3- 3-32	5	10	75c qu. Jan. 26
Arundel Corp. new com.	3- 8-32	23 actual sale		75c qu. Jan. 2	Medusa P. C. pfd. ⁴⁷	3- 9-32	50	60	
Bessemer L. & C. Class A.	3- 8-32		13½		Medusa P. C. com.	3- 8-32	6½	12	
Bessemer L. & C. 1st 6½'s ⁴	3- 4-32	25	50		Monarch Cement com. ⁴⁷	3- 9-32	60	70	
Bloomington Limestone 6's ²⁷	3- 9-32		25		Michigan L. & C. com. ⁴	3- 4-32	45		
Boston S. & G. new com. ²⁷	3- 4-32		6	15c qu. Jan. 2	Missouri P. C.	3- 8-32		12	25c qu. Jan. 30
Boston S. & G. new 7% pfd. ²⁷	3- 4-32	25	35	87½c qu. Jan. 2	Monolith Portland Midwest				
California Art Tile, A.	3- 4-32	1½	5¼		com. ⁷	3- 4-32	75c	1	
California Art Tile, B ⁴⁸	3- 3-32		3		Monolith P. C. com.	3- 5-32	1½		40c s.-a. Jan. 1
Calaveras Cement com. ⁹	3- 4-32		10		Monolith P. C. pfd.	3- 5-32	3	4	40c s.-a. Jan. 1
Calaveras Cement 7% pfd. ⁹	3- 4-32		70	1.75 qu. Jan. 15	Monolith P. C. units ⁹	3- 4-32	8½	10	
Canada Cement com.	3- 8-32	6½	7		Monolith P. C. 1st Mtg. 6's ⁹	3- 4-32	65	70	
Canada Cement pfd.	3- 8-32	61¼	63	1.62½ qu. Mar. 31	National Cem. (Can.) 1st 7's ²⁷	3- 9-32	90	95	
Canada Cement 5½'s ⁴²	3- 4-32	89½	91		National Gypsum A com. ²⁷	3- 9-32	2½	3	
Canada Crushed Stone bonds ⁴²	3- 4-32	68	75		National Gypsum pfd. ²⁷	3- 9-32	34	36	1.75 qu. Apr. 1
Canada Crushed Stone com. ⁴²	3- 4-32	5			National Gypsum 6's ³⁸	3-10-32	55	65	
Certainite Products com.	3- 8-32	2¾			Newaygo P. C. 1st 6½'s ²⁷	3- 9-32	79		
Certainite Products pfd.	3- 8-32	11	18½	1.75 qu. Jan. 1	New England Lime 6's, 1935 ¹⁴	3- 4-32	50	60	
Cleveland Quarries	3- 8-32		54	25c qu. Mar. 1	N. Y. Trap Rock 1st 6's	3- 7-32	69	actual sale	
Consol. Cement 1st 6½'s, A ⁴	3- 9-32	4	8		N. Y. Trap Rock 7% pfd. ²⁷	3- 4-32	52		1.75 qu. Jan. 2
Consol. Cement notes, 1941 ²⁷	3- 9-32	No market			North Amer. Cem. 1st 6½'s	3- 5-32	20	actual sale	
Consol. Cement pfd. ²⁷	3- 9-32		50		North Amer. Cem. com. ²⁷	3- 9-32	½	1	
Consolidated Oka Sand and Gravel (Canada) 6½'s ¹²	3- 7-32	85	90		North Amer. Cem. 7% pfd. ²⁷	3- 9-32	1	4	
Consolidated Oka Sand and Gravel (Canada) pfd. ⁴¹	3- 1-32	48		1.75 qu. Oct. 10, '31	North Shore Mat. 1st 5's ⁴⁷	3- 9-32	No market		
Consol. Rock Prod. com. ⁹	3- 4-32	25c	35c		Northwestern States P. C. ⁴⁷	3- 9-32	29	33	
Consol. Rock Prod. pfd. ⁹	3- 4-32	2	2½		Ohio River S. & G. com.	3- 8-32		8	
Consol. Rock Prod. units ²⁵	3- 3-32	1½	1¾		Ohio River S. & G. 7% pfd.	3- 8-32		98	
Consol. S. & G. pfd. (Can.)	3- 8-32	30	35	1.75 qu. Feb. 15	Ohio River S. & G. 6's ¹⁸	3- 5-32	70	80	
Construction Mat. com.	3- 8-32	¾	2		Oregon P. C. com. ⁹	3- 4-32	8	12	
Construction Mat. pfd.	3- 8-32	4	5¼		Oregon P. C. pfd. ⁹	3- 4-32	80	85	
Consumers Rock and Gravel, 1st Mtg. 6's, 1948 ²⁷	3- 3-32	37½	40		Pacific Coast Aggr. com. ⁴⁰	3- 3-32		25c	
Coosa P. C. 1st 6's ²⁷	3- 9-32	20	25		Pacific Coast Aggr. pfd. ⁴⁰	3- 3-32		50c	
Coplay Cem. Mfg. 1st 6's ³⁸	3- 4-32	50	70		Pacific Coast Aggr. 6½'s,				
Coplay Cem. Mfg. com. ³⁸	3- 4-32	5	7½		1944 ⁴⁵	3- 2-32	22	25	
Coplay Cem. Mfg. pfd. ³⁸	3- 4-32	25	40		Pacific Coast Aggr. 7's, 1939 ⁴⁵	3- 2-32	6	8	
Dewey P. C. com. ⁴⁷	3- 9-32	95	105		Pacific P. C. com.	3- 4-32	80		
Dole and Shepard	3- 8-32	18	21	\$1 qu. Jan. 1	Pacific P. C. pfd.	3- 4-32	3	8	
Dufferin Pav. & Cr. Stone pfd.	3- 8-32		45	1.75 qu. Jan. 2	Pacific P. C. 6's	3- 4-32	94½	100	1.62½ qu. Jan. 5
Dufferin Pav. & Cr. Stone com.	3- 8-32	2	4		Peerless Cement com. ¹	3- 5-32	25c	50c	
Edison P. C. com. ³²	3- 4-32	1½			Peerless Cement pfd. ¹	3- 5-32	2	8	
Edison P. C. pfd. ³²	3- 4-32	5			Penn.-Dixie Cement com.	3- 8-32	1	1¼	
Federal P. C. 6½'s, 1941 ¹⁹	3- 4-32	75	80		Penn.-Dixie Cement pfd.	3- 8-32	5½	6¾	
Giant P. C. com. ²	3- 4-32	1½	3		Penn.-Dixie Cement 6's	3- 5-32	42	actual sale	
Giant P. C. pfd. ²	3- 4-32	8	12	1.75 s.-a. Dec. 15	Penn. Glass Sand Corp. pfd.	2- 3-32	65	75	1.75 qu. Apr. 1
Gyp. Lime & Alabastine, Ltd.	3- 8-32	4 actual sale		10c. qu. Oct. 5, '31	Penn. Glass Sand Corp. 6's	2- 2-32	83	85	
Gyp. Lime & Alabastine 5½'s ⁴²	3- 4-32	59	65		Petoskey P. C.	3- 8-32	2¼	3¼	
Hermitage Cement com. ¹¹	3- 7-32	2	5		Port Stockton Cem. com. ⁹	3- 4-32	No market		
Hermitage Cement pfd. ¹¹	3- 7-32	30	35		Riverside Cement com. ⁹	3- 4-32		12	
Ideal Cement 5's, 1943 ²⁹	3- 5-32	90	95		Riverside Cement pfd. ⁹	3- 4-32	55	60	1.50 qu. Feb. 1
Ideal Cement com.	3- 8-32	18	20	50c qu. Jan. 2 & 25 ex. Dec. 22, '31	Riverside Cement, A.	3- 4-32		8	
Indiana Limestone units ²⁷	3- 9-32	No market			Riverside Cement, B ⁹	3- 4-32	70c	1	
Indiana Limestone 6's	3- 4-32	12	18		Roquemore Gravel 6½'s ¹⁷	3- 4-32	85	95	
International Cem. com.	3- 8-32	16¾	17	50c qu. Mar. 31	Sandusky Cement 6½'s,				
International Cem. bonds, 5's	3- 8-32	66 actual sale		Semi-ann. int.	1932-37 ¹⁷	3- 4-32	80	100	\$1 qu. Jan. 1 & \$2 ex. Dec. 24, '31
Kelley Is. L. & T. new stock	3- 8-32	14	14¼	25c qu. Jan. 1	Santa Cruz P. C. com.	3- 4-32		75	
Ky. Cons. Stone com.	3- 8-32		2		Schumacher Wallboard com.	3- 4-32	1½		
Ky. Cons. Stone pfd.	3- 8-32		50	1.75 qu.	Schumacher Wallboard pfd.	3- 4-32		15	50c qu. Feb. 15
Ky. Cons. St. 1st Mtg. 6½'s ⁴⁸	3- 3-32	30	40		Southwestern P. C. units ³⁰	3- 3-32	150	200	
Ky. Cons. St. V. T. C. ⁴⁸	3- 3-32	1	2		Standard Paving & Mat.				
Ky. Rock Asphalt com.	3- 8-32	1¾	2½		(Canada) com.	3- 8-32	2¼	2½	
Ky. Rock Asphalt pfd.	3- 8-32	25	30	1.75 qu. Dec. 1, '31	Standard Paving & Mat. pfd.	3- 8-32		45	1.75 qu. Feb. 5
Ky. Rock Asphalt 6½'s	3- 8-32	80	85		Superior P. C., A.	3- 4-32	28	30	27½c mo. Mar. 1
Lawrence P. C. ⁹	3- 5-32	10	15		Superior P. C., B.	3- 4-32	5½	7	25c Dec. 21, '31
Lawrence P. C. 5½'s, 1942 ²	3- 5-32	42			Trinity P. C. units ⁴⁷	3- 9-32	35	45	
Lehigh P. C. com.	3- 8-32	6	6½		Trinity P. C. com. ²¹	2-23-32	10		
Lehigh P. C. pfd.	3- 8-32	67 actual sale		1.75 qu. Apr. 1	U. S. Gypsum com.	3- 8-32	24½	25	40c qu. Mar. 31
Louisville Cement ⁴⁸	3- 8-32	175	225		U. S. Gypsum pfd.	3- 9-32	110	114¾	1.75 qu. Mar. 31
Lyman-Richey 1st 6's, 1932 ¹²	3- 4-32	95			Wabash P. C. ²¹	3- 4-32		17	
Lyman-Richey 1st 6's, 1935 ¹²	3- 4-32	90			Warner Co. com. ¹⁸	3- 5-32	4½	6	25c qu. Oct. 15, '31
Marblehead Lime 6's ¹⁴	3- 4-32	60	70		Warner Co. 1st 7% pfd. ¹⁸	3- 5-32	60	70	1.75 qu. Apr. 1

Quotations by: ¹Watling Lerchen & Hayes Co., Detroit, Mich. ²Bristol & Willett, New York. ³Rogers, Tracy Co., Chicago. ⁴Butler, Beadling & Co., Youngstown, Ohio. ⁵Smith, Camp & Riley, San Francisco, Calif. ⁶Frederick H. Hatch & Co., New York. ⁷J. J. B. Hilliard & Son, Louisville, Ky. ⁸Dillon, Read & Co., Chicago, Ill. ⁹A. E. White Co., San Francisco, Calif. ¹⁰Lee Higginson & Co., Boston and Chicago. ¹¹J. W. Jakes & Co., Nashville, Tenn. ¹²James Richardson & Sons, Ltd., Winnipeg, Man. ¹³Stern Bros. & Co., Kansas City, Mo. ¹⁴First Wisconsin Co., Milwaukee, Wis. ¹⁵Central-Republic Bank & Trust Co., Chicago. ¹⁶J. S. Wilson, Jr., Baltimore, Md. ¹⁷Citizens Southern Co., Savannah, Ga. ¹⁸Dean, Witter & Co., Los Angeles, Calif. ¹⁹Hewitt, Ladin & Co., New York. ²⁰Tucker, Hunter, Dulin & Co., San Francisco, Calif. ²¹Baker, Simonds & Co., Inc., Detroit, Mich. ²²Peoples-Pittsburgh

Trust Co., Pittsburgh, Penn. ²³Howard R. Taylor & Co., Baltimore. ²⁴Richards & Co., Philadelphia, Penn. ²⁵Hincks Bros. & Co., Bridgeport, Conn. ²⁶Bank of Republic, Chicago, Ill. ²⁷National City Co., Chicago, Ill. ²⁸Chicago Trust Co., Chicago, Ill. ²⁹Boettcher-Newton & Co., Denver. ³⁰Hanson and Hanson, New York. ³¹S. F. Holzinger & Co., Milwaukee, Wis. ³²Tobey and Kirk, New York. ³³Steiner, Rouse and Co., New York. ³⁴Jones, Heward & Co., Montreal, Que. ³⁵Tenney, Williams & Co., Los Angeles, Calif. ³⁶Stein Bros. & Boyce, Baltimore, Md. ³⁷Wise, Hobbs & Arnold, Boston. ³⁸E. W. Hays & Co., Louisville, Ky. ³⁹Blythe Witter & Co., Chicago, Ill. ⁴⁰Martin Judge Co., San Francisco, Calif. ⁴¹A. J. Pattison Jr. & Co. Ltd., Toronto, Canada. ⁴²Neubitt, Thomson & Co., Toronto. ⁴³E. H. Rollins, Chicago. ⁴⁴Dunlap, Wakefield & Co., Louisville, Ky. ⁴⁵First Union Trust & Savings Bank, Chicago. ⁴⁶Anderson, Plotz and Co., Chicago, Ill.

How United States Gypsum Co. Meets Depression

THE United States Gypsum Co., Chicago, Ill., has been able to reduce overhead in line with smaller volume of business, and for the first six months of this year it will be about 30% less than in like period a year ago, according to budget figures. At present expenses are running about 3% less than the projected budget. During past few months company's expenses have shown a consecutive monthly decline and present indications are that March overhead will be less than in previous month.

Instead of discharging its competent junior executives, the management has worked out a plan whereby they are in a sense temporarily demoted to other positions. Employees have shown complete willingness to cooperate in this respect, Sewell L. Avery, president, said.

There is no immediate need for new building, according to Mr. Avery, and in his estimation there is nothing which can bring about an increase in new construction in the near future. Although remodeling and repairing make up the bulk of present construction, the U. S. Gypsum Co. is in a position to benefit from this type work because it has a complete line of wall board and tile which is used extensively for this purpose.

Through its expansion program the company prepared for the present depression since through its larger units of production and distribution it effected economies of op-

erations and received a larger portion of the total business.

Stockholders voted to set aside 5500 shares of the company's common stock to be sold to executives at current market prices as designated by Mr. Avery. This has been the company's policy in previous years.—*The Wall Street Journal* (New York City).

Recent Dividends Announced

Alpha Portland Cement pf'd. (qu.)	\$1.75, Mar. 15
National Gypsum pf'd. (qu.)	1.75, Apr. 1
Pennsylvania Glass Sand pf'd. (qu.)	1.75, Apr. 1
United States Gypsum com. (qu.)	0.40, Mar. 31
United States Gypsum pf'd. (qu.)	1.75, Mar. 31

North American Cement

THE ANNUAL REPORT of the North American Cement Corp., Albany, N. Y., for year ended December 31, 1931, shows net loss of \$496,520 after interest, depreciation, depletion, etc. This compares with net profit in 1930 of \$263,092, equivalent to \$5.09 a share (par \$100), on 51,500 shares of 7% preferred stock, on which there is an accumulation of unpaid dividends.

Current assets as of December 31, 1931, including \$663,537 in cash, totaled \$1,529,186 and current liabilities were \$229,549, comparing with cash of \$735,354, current assets of \$1,892,407 and current liabilities of \$276,631 at end of 1930.

INCOME ACCOUNT OF NORTH AMERICAN CEMENT CORP., 1928-1931

	1931	1930	1929	1928
Net sales	\$3,292,557	\$4,584,574	\$4,863,582	\$5,538,741
Costs and expenses	2,743,264	3,149,674	3,430,508	4,159,242
Balance	\$549,293	\$1,434,900	\$1,433,074	\$1,379,499
Other income	28,144	23,575	26,745	36,024
Total income	\$577,437	\$1,458,475	\$1,459,819	\$1,415,523
Depreciation and depletion	711,602	723,253	662,513	672,175
Interest, amortization, etc.	362,355	449,772	491,643	562,248
Federal taxes		22,358	23,369	*
Net loss	\$496,520	†\$263,092	†\$282,294	†\$181,100
Preferred dividends		88,443	90,125	90,125
Deficit	\$496,520	†\$174,649	†\$192,169	†\$90,975

*Company wrote off from surplus during 1928, \$295,295 for the replacement of obsolete machinery, making unnecessary any reserve for federal taxes. †Profit. ‡Surplus.

The balance sheet of North American Cement Corp. as of December 31, 1931, compares as follows:

Income account for year 1931 compares as above:

BALANCE SHEET COMPARISONS OF NORTH AMERICAN CEMENT CORP., 1928-1931

ASSETS				
	1931	1930	1929	1928
*Real estate, buildings, equities, etc.	\$12,613,782	\$12,926,779	\$13,453,098	\$13,946,741
Cash	663,537	735,354	778,979	359,888
Accounts and notes receivable	205,356	364,468	258,047	442,611
Inventories	660,293	792,586	1,015,089	966,297
Investment at cost	7,250	7,250	62,798	27,015
Treasury securities at cost	241,480	298,700		
Sinking fund	584	584	584	584
Deferred charges	545,899	608,031	661,168	715,812
Total	\$14,938,184	\$15,733,752	\$16,229,763	\$16,458,948
LIABILITIES				
Preferred stock	\$5,150,000	\$5,150,000	\$5,150,000	\$5,150,000
†Common stock	1,412,500	1,412,500	1,412,500	1,412,500
Bonds	6,615,500	6,880,500	7,135,500	7,366,500
Accounts payable	40,185	56,428	302,824	358,955
Accounts w.g., interest, etc.	162,482	181,269	200,466	206,616
Plant addition			54,000	294,663
Federal tax reserve	26,882	38,935	32,369	
Reserves	72,492	62,636	66,183	59,941
Interest and earned surplus	1,458,143	1,951,484	1,875,921	1,609,773
Total	\$14,938,184	\$15,733,752	\$16,229,763	\$16,458,948

*After depreciation and depletion. †Represented by 33,250 no-p-r shares.

Consolidated Oka Sand and Gravel Co. (Canada)

TOTAL SALES of Consolidated Oka Sand and Gravel Co., Montreal, Que., in 1931 were \$513,443, a decline of about 16%, and net earnings totaled \$127,201 compared with \$158,260 in the previous year. After provision for depreciation, bond interest and organization expense, net profits were \$36,433 compared with \$64,128 in 1930.

Preferred dividend payments totaling \$49,119 entailed drawing on surplus to the extent of \$12,686, which, with deduction of \$4761 for other taxes, reduced surplus to \$46,545 as opposed to \$63,993 at the beginning of the year. The balance sheet reflects the granting of supplementary letters patent, authorizing the conversion of the no par value common shares into shares of a par value of \$5.

It is pointed out that since the beginning of December, 1931, there has been a very decided falling off in the volume of the company's sales. Part of this is held due to the usual seasonal decline, but prospects indicate a marked reduction in the amount of business offering, it is stated. Economies put into effect since the end of the year, however, are expected by the management to offset the anticipated reduction in earnings to some extent.

Following are details of profit and loss for the past three years:

	1931	1930	1929
Net earnings	\$127,201	\$158,260	\$202,883
Depreciation	43,487	43,907	37,815
Bond interest	44,402	45,348	45,500
Organization expense	2,878	2,877	2,246
Sinking fund			2,333
Bonded debt reserve			4,284
Other reserve		2,000	3,100
Special depreciation			10,000
Net profit	\$36,433	\$64,128	\$97,605
Preferred dividends	49,119	49,119	49,252
Surplus	†\$12,686	\$15,009	\$48,353
Previous surplus	63,992	50,990	4,679
Total	\$51,306	\$65,999	\$53,032
*Other taxes	4,761	5,558	3,042
Adjustments		630	1,500
Balance	\$46,545	\$59,810	\$48,480
Adjustments		4,183	2,500
Profit and loss balance	\$46,545	\$63,993	\$50,990

*For prior years.
†Deficit.

Working capital shows a reduction of \$19,000 at \$72,783, comprising current assets of \$167,502 and \$94,719. Cash is down \$9000 at \$40,651, while accounts receivable have dropped \$23,000 to \$45,527. Inventories, consisting chiefly of 84,689 tons of sand, are valued at \$60,246—a reduction of \$29,000. Insurance claims are slightly higher, at \$1142.

Depreciated value of fixed assets is down \$70,000 at \$1,715,468. In this connection it is noted that the Bridge Street terminal, carried at \$30,000 in 1930, was abandoned during last year as the property, it is stated, was no longer useful and the expense of its maintenance had become burdensome.

In liabilities bank loans are unchanged at \$45,000 and accounts payable are down \$42,000 at \$30,170. Funded debt has been re-

duced by \$15,000 to \$671,000 and a deferred liability representing the amount due on account of the Robertson property, purchased in 1930, has been reduced by \$25,166 to \$49,833.

Reflecting the conversion of the common stock into shares of \$5 par value, the 21,000 shares are now carried at \$105,000 compared with \$352,883 in 1930.

In his report to shareholders the president, James Playfair, said, in part:

"The business of your company was well maintained during the first 11 months of the year but since the first of December there has been a very decided falling off in the volume of sales. Part of this is due to the usual seasonal decline, but the prospects indicate a marked reduction in the amount of business offering. Many economies have been put into effect since the end of the year which will result in considerable saving in the cost of operations and to quite an appreciable extent will offset the anticipated reduction in earnings."—*Financial Post* (Toronto, Ont.).

United States Gypsum Co.

SEWELL L. AVERY, president of the United States Gypsum Co., Chicago, Ill., reports: The net income for the year ended December 31, 1931, was \$3,563,142.80, after deducting depreciation, depletion and federal income taxes. This net income, after providing for the 7% dividend on the preferred stock, is equal to \$2.48 per share on common stock outstanding.

Cash dividends of \$2,454,884.35 were paid. The net amount added to earned surplus was \$440,188.09 after deductions of \$551,450.76 to charge off abandoned plants and \$116,619.60 to adjust Canadian balance sheets for depreciation in Canadian exchange. The paid-in surplus was increased \$129,750.81, as a result of the issuance of stock for the purchase of property and other uses.

Plant additions for the year amounted to \$2,061,297.11, of which \$880,449.07 was expended for the purchase and improvement of a lime plant at Guelph, Ontario; the construction of a complete gypsum unit at Hagersville, Ontario, including mine, mill, wallboard and block plant, and the addition of a wallboard unit to the recently acquired gypsum property at Hillsborough, New Brunswick. These plants are all in successful operation. The sum of \$1,180,848.04 was expended during the year for additions and improvements to the recently acquired metal lath and insulation board plants, and for the maintenance at high standard of the company's properties throughout the U. S.

The drastic decline in the consumption of building products made 1931 a difficult year. To some extent this was offset by rigid manufacturing and distribution economies and by the marketing of newer products.

CONSOLIDATED BALANCE SHEET OF THE UNITED STATES GYPSUM CO.

(As of December 31, 1931)

ASSETS

Current assets:			
Cash and cash resources			
Bank balances and working funds.....	\$	923,034.18	
Marketable securities, including accrued interest, at cost (market value, \$9,634,461).....			
U. S. Government securities.....	\$9,180,467.46		
Municipal bonds	1,064,917.79	10,245,385.25	
			\$11,168,419.43
Receivables			
Accounts and notes.....	\$3,490,465.33		
Construction contracts	229,265.80		
			\$3,719,731.13
Less—Reserves for bad debts.....	467,618.43	3,252,112.70	
Inventories of finished goods, raw materials, supplies, etc., as taken by the company, priced at cost which is not in excess of market.....		3,736,901.06	\$18,157,433.19
Stock subscriptions receivable, investments, etc.:			
Employees' stock purchase contracts.....	\$	1,657,749.61	
Bonds on deposit for insurance reserve, including interest—at cost.....	180,592.38		
Miscellaneous stocks and bonds—at book value.....	86,246.19	1,924,588.18	
Plant and equipment—at book value:			
Land, gypsum, buildings, machinery, steamers, etc.....	\$61,178,091.47		
Less—Reserves for depreciation and depletion.....	12,444,012.10	48,734,079.37	
Deferred charges:			
Stripping costs, amortizable patent expenditures and prepaid expenses.....		1,071,295.68	
			\$69,887,396.42

LIABILITIES

Current liabilities:			
Accounts payable	\$	577,491.68	
Accrued liabilities			
Payrolls, local taxes, etc.....	\$269,509.62		
Federal income taxes.....	329,285.30	598,794.92	\$ 1,176,286.60
Reserves:			
Contingencies	\$	876,765.83	
Accident insurance, guarantees, etc.....	478,953.60	1,355,719.43	
Capital stock and surplus:			
7% cumulative preferred stock, \$100 par value			
Authorized, 100,000 shares			
Issued and outstanding, 78,222 shares (87,277 shares issued less 9055 shares in treasury).....		\$ 7,822,200.00	
Common stock, \$20 par value			
Authorized—3,000,000 shares			
Issued and outstanding, 1,217,472 shares (1,251,821 shares issued less 34,349 shares in treasury).....		24,349,440.00	
Surplus			
Paid-in surplus	\$ 6,507,998.95	35,183,750.39	67,355,390.39
Earned surplus	28,675,751.44		\$69,887,396.42

CONSOLIDATED PROFIT AND LOSS ACCOUNT OF THE UNITED STATES GYPSUM CO. AND SUBSIDIARY COMPANIES

(Years ended December 31, 1930 and 1931)

	1931	1930
Net profits on operations before provisions for depreciation, depletion and income taxes	\$ 5,789,927.18	\$ 7,835,520.06
Other profits and income.....	717,212.05	683,132.89
Total.....	\$ 6,507,139.23	\$ 8,518,652.95
Deductions from income.....	343,694.60	259,863.15
Net profits from all sources before provisions for depreciation, depletion and income taxes	\$ 6,163,444.63	\$ 8,258,789.80
Deduct—Provisions for		
Depreciation and depletion.....	\$ 2,256,402.58	\$ 2,163,030.62
Income taxes	343,899.25	687,073.71
Total.....	\$ 2,600,301.83	\$ 2,850,104.33
Net profits for year.....	\$ 3,563,142.80	\$ 5,408,685.47

Operations of the Canadian subsidiaries for the year 1931 are included in the above profit and loss account on the basis of average exchange rates prevailing during that year. Adjustment of balance sheets of Canadian subsidiaries as of December 31, 1931, for depreciation in Canadian exchange has been charged to earned surplus.

SUMMARY OF CONSOLIDATED SURPLUS ACCOUNTS OF THE UNITED STATES GYPSUM CO. AND SUBSIDIARY COMPANIES

(Years ended December 31, 1930 and 1931)

	1931	1930
Paid-in surplus:		
Balance at beginning of year.....	\$ 6,378,248.14	\$ 4,844,232.64
Surplus credits resulting from issuance of stock.....	129,750.81	1,534,015.50
Balance at end of year.....	\$ 6,507,998.95	\$ 6,378,248.14
Earned surplus:		
Balance at beginning of year.....	\$28,235,563.35	\$25,840,531.78
Add—Net profits for year.....	3,563,142.80	5,408,685.47
Total.....	\$31,798,706.15	\$31,249,217.25
Deduct		
Adjustment of balance sheets of Canadian subsidiaries as of December 31, 1931, for depreciation in Canadian exchange.....	\$ 116,619.60	
Loss on retirement of abandoned plants.....	551,450.76	
Cash dividends paid		
On preferred stock.....	548,752.75	\$ 543,669.00
On common stock.....	1,906,131.60	2,469,984.90
Total.....	\$ 3,122,954.71	\$ 3,013,653.90
Balance at end of year.....	\$28,675,751.44	\$28,235,563.35

Riverside Cement Report

EXTRACTS from the annual report of John Treanor, president of the Riverside Cement Co., Riverside, Calif., are quoted as follows: The profits for the year 1931, after provision for depreciation, depletion and federal income tax, were \$401,372.53, as compared with the dividend requirements upon the first preferred stock of \$345,774. The 1931 provision for depreciation and depletion was in keeping with the established policy of the company and amounted to \$352,085.37, of which \$312,085.37 was appropriated from 1931 earnings and \$40,000 was transferred from other reserve accounts which were in excess of requirements.

During 1931, dividends in the sum of \$345,774 were paid on the preferred stock of the company. Dividends amounting to \$36,000 were paid on the Class "A" stock. During the year the company retired 1463 shares of its preferred stock, leaving outstanding a present total of 59,574 shares. Of this amount the company has

CONDENSED CONSOLIDATED BALANCE SHEET OF THE RIVERSIDE CEMENT CO.

(December 31, 1931)

Assets:	
Cash	\$ 947,442.12
Notes and accounts receivable, less provision for discounts and bad debts	326,647.73
Inventories: Cement, supplies, etc., at cost	1,012,508.85
Total current assets	\$ 2,286,598.70
Stocks and bonds	238,524.37
Treasury stock	260,041.50
Represented by 3889 shares first preferred	
Other investments	560,127.84
Deferred charges	41,726.31
Real estate, plant and equipment, less depreciation and depletion	8,234,127.53
Total assets	\$11,621,146.25
Liabilities:	
Payrolls, accruals and accounts payable	\$ 143,723.03
Reserve for federal income tax	36,027.38
Total current liabilities	\$ 179,750.41
Other reserves	150,331.30
Sundry items	60,313.00
Capital	9,552,500.00
Represented by:	
59,574 shares first preferred stock	
240,000 shares Class "A" stock	
345,000 shares Class "B" stock	
Earned surplus	\$ 155,929.01
Surplus appropriated for retirement of first preferred stock	154,779.48
Capital surplus	1,367,543.05
	1,678,251.54
Total liabilities	\$11,621,146.25

purchased and holds for future retirement 3889 shares. The original issue of preferred stock was 65,000 shares.

The regular quarterly dividend of \$1.50 per share upon the preferred stock of the company, payable February 1, 1932, was declared at a meeting of the directors held on January 5, 1932.

In the condensed consolidated balance sheet of the company as of December 31, 1931, no adjustment has been made for decline in market value of stocks and bonds, which are carried on the balance sheet at cost. The company's present ratio of total current assets to total current liabilities is approximately 13:1. The

ratio of cash to total current liabilities is over 5:1.

One year ago the directors declined to venture any prediction concerning the probable course of operations during the year 1931. They deem it advisable to maintain this attitude with respect to 1932. Since the entire construction industry is so closely related to general business activity, they feel that specific prophecy concerning the cement business should be deferred until general business recovery can be clearly foreseen. But it is permissible to point out the following facts:

(1) Tonnage sales in 1931 were 64% of 1930 tonnage.

(2) Net profits in 1931 were, however, 79% of 1930 net profits.

(3) Net profits in 1931 (\$401,372.53) were obtained from the operation of less than one-third of the company's capacity.

Annual Report of the Arundel Corp.

THE Arundel Corp., Baltimore, Md., producer of sand and gravel, and dredging contractor, reports for the year ending December 31, 1931:

BALANCE SHEET OF THE ARUNDEL CORP.
(As of December 31, 1931)

ASSETS	
Current assets:	
Cash	\$ 580,120.70
Marketable securities at cost (market value \$1,772,476.88)	1,879,377.66
Accounts receivable	1,312,316.30
Notes receivable	6,619.61
Accrued interest and sundry debtors	28,010.88
Materials and supplies	27,229.18
	\$3,833,674.33
Investments and deferred assets:	
Other accounts receivable	\$ 153,471.66
Stock of the Arundel Corp., 5115 shares, at cost	199,635.38
Other stocks and bonds, at cost	491,576.17
Mortgage receivable	45,000.00
	889,683.21
Fixed assets:	
Land, buildings, machinery, floating equipment, etc., at values as appraised by Lockwood Green Co., Inc., as of September 1, 1919, subsequent acquisitions at cost	\$8,717,376.69
Less reserve for depreciation and depletion	3,960,905.46
	4,756,471.23
Deferred charges to future operations:	
Prepaid insurance	\$ 40,839.96
Prepaid expense on contracts	218,700.07
Prepaid expense, shipyard	715.08
	260,255.11
	\$9,740,083.88
LIABILITIES	
Current liabilities:	
Dividend payable January 2, 1932	\$ 369,392.25
Accounts payable	718,050.57
Accrued expenses and other liabilities	26,988.52
	\$1,114,431.34
Deferred income on contracts	15,991.92
Reserve for insurance	139,385.58
Capital stock:	
Authorized, 500,000 shares of no par value:	
Whereof 495,426 shares issued for	\$4,954,260.00
Less 2870.4 shares reacquired and held in treasury	28,704.00
	\$4,925,556.00
Surplus, per accompanying statement	3,544,719.04
	8,470,275.04
Contingent liabilities:	
Subscription to barge syndicate	\$176,433.76
As guarantor of notes of affiliated corporations	390,000.00
	\$566,433.76
	\$9,740,083.88

STATEMENT OF SURPLUS FOR THE YEAR 1931

Balance, January 1, 1931	\$5,074,725.53
Income from operations for the year 1931	2,033,102.60
	\$7,107,828.13
Deduct:	
Dividends	\$1,477,567.50
Loss on abandonment and reconstruction of fixed assets	20,623.55
Loss on notes of Everglades Drainage District and of other receivables	1,980,241.71
Additional provision for federal tax on income for 1930	84,676.33
	3,563,109.09
Balance, December 31, 1931	\$3,544,719.04

Marquette Contemplates Water Shipments to Chicago

IN THE COURSE of a hearing in Chicago, Ill., over the question of bridge clearances on the waterway near there, D. S. Volburn, representing the Marquette Cement Manufacturing Co., stated that his company planned to handle 250,000 tons of cement annually into Chicago when the channel is completed so that such movement would be completed so that shipments of cement can be made in that way.—*Seattle (Wash.) Times*.

Exports of Phosphate from Florida

FLORIDA exported 62,311 tons of phosphate to 33 countries during the first half of 1931, according to United States shipping board figures. Virtually all of this was shipped from Tampa. The United States exported 66,729 tons during this period. Japan received 19,403 tons, more than any other country. The Netherlands took 13,615 tons, Italy 8,346 tons, Atlantic Canada and Newfoundland 8,000, Germany 6,299 and Spain 5,211 tons.—*Wall St. (N. Y.) Journal*.

Traffic and Transportation

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week ending March 5:

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

24595. Crushed stone (trap rock), (See Note 3), from Westfield, Mass., to Oak Street, Springfield, Bondsville, Enfield, Greenwich, Greenwich Village, Mass. Proposed, 45.5c per net ton. Present—Oak Street, Springfield and Bondsville, Mass., 50c per net ton; remainder, 90c. (See Note 4.)

24694. Stone, crushed or broken; stone, grout or rubble (waste products of quarries), minimum weight 80,000 lb., from E. Barre, Graniteville and Webster, Vt., to Barre, Vt. Present, 3; proposed, 2½. (See Note 4.)

TRUNK LINE ASSOCIATION DOCKET

28693. Limestone, unburned, ground, carloads, minimum weight 50,000 lb., from Rosendale, N. Y., to L. I. R. R., Groups A, 14½c; B, 16c; C, 17c, and D, 19½c per 100 lb. (Present rates, sixth class.) Reason—Proposed rates are comparable with rates from Dover Plains, N. Y., to same destinations.

28694. (A) Building lime, carloads, minimum weight 30,000 lb.; (B) agricultural and land lime, carloads, minimum weight 30,000 lb.; (C) chemical, gas and glass lime, carloads, minimum weight 30,000 lb., and (D) ground limestone, carloads, minimum weight 50,000 lb., from Bellefonte, Pleasant Gap and Chemical, Penn., to Winslow Jct., N. J., (A) 16c, and (B), (C) and (D), 14½c per 100 lb., and to Elwood, N. J., (A) 16c, and (B), (C) and (D), 15½c per 100 lb. Reason—Proposed rates are comparable with rates from Martinsburg, W. Va., group.

M-2016. Establish rates on cement, carloads, from Lehigh district to all stations on the Valley R. R. of Pennsylvania, 18c per 100 lb., except to Kusequa, Penn., to which point rate of 16c per 100 lb. will apply.

M-2024. Cement, carloads, minimum weight 80,000 lb., from Buffalo, N. Y., to Attica, N. Y., 137c per net ton, subject to emergency charge and to expire March 31, 1933, and rate of 7½c per 100 lb., to apply on and after April 1, 1933. (See Note 4.)

28627. Cement, natural, hydraulic or portland, carloads, minimum weight 50,000 lb., from Montreal, Que., to Philadelphia, Penn., 19½c per 100 lb.

28701. Fluxing lime, carloads, having no commercial value for building or chemical purposes, minimum weight 36,000 lb., from Bellefonte and Pleasant Gap, Penn., to Butler, Penn., 9½c per 100 lb. (Present rate, 11c per 100 lb.) Reason—Proposed rate is comparable with rates on like commodities from and to points in the same general territory.

28702. Stone, crushed or quarry broken, carloads (See Note 2), from Jamesville, N. Y., to Carbondale, Penn., 150c per net ton. (Present rate, 175c per net ton.) Reason—Proposed rate is comparable with rate to Mayfield, Penn., etc.

28705. Stone, natural (other than bituminous asphalt rock), crushed, carloads (See Note 2), from Watertown, N. Y., to Constable, N. Y., 170c per net ton. Present rate, 230c per net ton. Reason—Proposed rate is comparable with rate to Spring Cove and Fork Pond, N. Y.

28353. Slag, carloads (See Note 2), from Easton and Hokendauqua, Penn., to Cresco, Mountain Home, Penn., \$1.10, and Mt. Pocono, Pocono Summit, Tobyhanna and Gouldsboro, Penn., \$1.20 per net ton.

28580. Slag, carloads (See Note 2), to Sandy Run, Penn., from Easton, Bethlehem, Penn., \$1, and from Hokendauqua, Penn., 90c per net ton.

28715. Sand (other than blast, engine, foundry, glass, molding or silica) and gravel, carloads (See Note 2), from Smiths Siding, Md., to Sykesville, Md., 80c per net ton. (Present rate 90c.) (See Note 5.)

28718 (shipper). Limestone (finely ground), carloads, minimum weight 50,000 lb., from Annaville, Penn., to Easton, Md., 12c per 100 lb. (Present rate, 19c per 100 lb., sixth class.) Reason—Proposed rate is comparable with rate from Annaville, Penn., to Greensboro, Md.

28736. Slag, in bulk, carloads (See Note 2), from Bethlehem, Penn., to Elkins Park, Penn., 70c per net ton. To expire six months after date rate is made effective. Subject to W. S. Curlett's Tariff Emergency Charges, I. C. C. No. A-356. (Present rate, \$1.05 per net ton.) (See Note 4.)

28748. To cancel commodity rates on limestone, unburned, ground, carloads (See Note 2), from Natural Bridge, N. Y., to P. R. R. stations: New Brunswick, N. J.; Torresdale to Englewood, Penn., incl.; Trenton, N. J.; Camden, N. J.; Vine St. Track, Piers 13 and 15, North, and Yard, Philadelphia, Penn., to Overbrook, Philadelphia, Penn., incl.; Lancaster, Penn.; Wynnefield Ave., Philadelphia, Penn., to Shawmont, Penn.; Broad St. and Washington Ave., Philadelphia, Penn., to Par-schall, Penn., incl.; Marcus Hook, Penn.; 31st and Chestnut St., W. Philadelphia, to End Cardington Branch, Penn., incl.; Kearney, Penn. (H. & B. T. Mt. R. & C. Co.), as shown in Item 11847 of Tariff N. Y. C. R. R., I. C. C. N. Y. C. No. 15701. Sixth class rate to apply. Reason—Investigation develops no traffic has moved for some time nor is there prospects for future shipments, therefore rates are obsolete.

28352. Glass sand, carloads (See Note 2), from Mapleton, Penn., district points, and Tatesville, Penn., to Alloy, W. Va., \$2.60 per net ton.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Note 4—Reason—To meet motor truck competition.

Note 5—Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

28760. Sand, building and engine, in open top equipment, carloads (See Note 2), from Cumberland, Md., to Baltimore, Md., \$1.40 per net ton. Reason: Proposed rate is comparable with rates from Cumberland, Md., to destinations on the B. & O. R. R., Monongahela Ry., etc.

28767. Stone, natural, other than bituminous asphalt rock, crushed, carloads (See Note 2), from Buckeystown, Md., Engle, W. Va., Frederick, Md., Grove, Md., Kearneysville, W. Va., Lime Kiln, Md., Martinsburg, W. Va., and Millville, W. Va., to Pennsylvania Jct., Mt. Calvert, Pindell, Fischer, Md., \$1.50; Mt. Harmony, Chesapeake Beach, Md., \$1.65 per net ton. Reason: Proposed rates are comparable with rates to District Line, Marlboro, Owings, Md., etc.

28768. Gravel, sand (other than blast, core, engine, fire, glass, grinding, molding, quartz, siliceous or silica), carloads (See Note 2),

To—	Proposed
Kennedy, N. Y.	\$1.10
Falconer, N. Y.	1.10
Jamestown, N. Y.	1.10

To—	Proposed
Kennedy, N. Y.	\$1.10
Rates in cents per net ton. (See Note 5.)	

28770. To cancel commodity rates on building sand, carloads, from Hummel, Penn., to P. R. R. points as shown in P. R. R. G. O. I. C. C. No. 13618. Classification basis to apply. Reason: Investigation develops sand plant at Hummel, Penn., is no longer in operation and no prospects of plant being reopened, therefore rates are obsolete.

28772. To cancel present commodity rates on sand, blast, engine, foundry, glass, molding, quartz, siliceous or silica, from Shamokin, Penn., to Ashland, Bloomsburg, Brandonville, Clement, Catawissa, Frackville, Gilberton, Girardville, Gordon, Herndon, Lewisville, Mahanoy City, Mt. Carmel, Milton, Mainville, McAuley, Minersville, New Philadelphia, Pine Grove, Port Carbon, Pottsgrove, Pottsville, Pottsville (12th St.), Rupert, St. Clair, St. Nicholas, Schuylkill Haven, Shenandoah, Sunbury, Tamaqua, W. Milton and Winfield, Penn., shown in Reading Company Tariff I. C. C. 739. Class rates to apply. Reason: Investigation develops no traffic has moved for some time, nor is there prospects for future shipments, therefore rates are obsolete.

28782. Sand, other than blast, engine, foundry, molding, glass, silica, quartz or siliceous gravel, carloads (See Note 2), from Williamsport, Penn., to P. R. R. stations, Fardee to Oak Hall, Penn., and B. C. R. R. stations, Waddle to State College, Penn., inclusive, \$1 per net ton. (See Note 5.)

CENTRAL FREIGHT ASSOCIATION DOCKET

30661. To establish on stone, viz., rough (not dimension), rubble, rip rap and quarry scrap, from Chicago, Ill., to Wabash Ry. destinations, viz.: Gary, Calumet, Willow Creek, 101c; Crocker, Morris, Westville, 113c; Magee, Kingsbury, Dillon, 126c; North Liberty, Pine, Lakeville, Wyatt, 139c; Wakarusa, Foraker, New Paris, Benton, Millersburg, 151c; Topeka, 176c; Stoney Creek, 151c; Eddy, Wolcottville, South Milford, Stroh, Helmer, 176c; Steubenville, Hamilton, Ind., Montpelier, Eden, 189c; Kunkle, Alvordton, Franklin, O., Munson, North Morenci, 202c; Seneca, Sand Creek, South Adrian, Adrian, Raisin Center, Holloway, Britton, 214c; Cone, Milan, Whittaker, Willis, Belleville, 227c; French Landing, Romulus, Hand, Oakwood, Delray and Detroit, Mich., 239c per net ton. Present, sixth class.

30664. To establish on waste or refuse stone in open top cars, carloads (See Note 1), except when car is loaded to full cubical or visible capacity actual weight will apply, to Jamestown, Penn., from Wurttemberg and Rock Point, Penn., rate of 100c per net ton. Present, 12c (sixth class).

30666. To establish on refuse fuller's earth, carloads, minimum weight 60,000 lb., from Chicago, Ill., to Stroh, Ind., 125c; Alpena, 225c; Bay City, 200c; Cement City, 150c; Detroit, Fenton, 170c; Port Huron, 200c; Wyandotte, Mich., 170c per net ton. Present—14½c to Stroh, Ind.; 23c, Alpena; 18½c, Bay City; 16c, Cement City; 18½c, Detroit, Fenton; 19c, Port Huron; 18½c, Wyandotte, Mich.

30706. To establish on sand and gravel, carloads, from Troy, O., to Toledo, Rossford, Bates, Perrysburg, Roachton, Hull Prairie, Haskins, Tontogany, Weston, Milton, Custar, Hoytville, North Baltimore, Bays, Rudolph, Portage, Bowling Green, O., rate of 90c; to Standley and Defiance, O., 100c per net ton. Present, 340c (sixth class rate of 17c converted to net ton basis) to Toledo, Rossford, Bates, O., per C. F. A. L. Tariff 481; 115c to Perrysburg, Roachton; 110c, Hull Prairie, Haskins; 105c, Tontogany; 100c, Weston; 95c, Milton, Custar, Hoytville; 105c, North Baltimore, Bays, Rudolph, Portage, Bowling Green, Standley; 115c per net ton, Defiance, O.

30716. To establish on crushed stone or crushed stone screenings, in open top cars, carloads, from Bellevue, O., to Leetonia, 125c; Mineral Ridge, 115c; Niles, O., 100c per net ton. Present, 340c to Leetonia and 360c to Mineral Ridge, 140c per net ton to Niles, O.

30720 (cancels W. D. A. 30118). (a) To cancel Item 1655 of C. F. A. L. Tariff 130-T, wherein is published equivalent table of rates on limestone, agricultural, or agricultural limestone screenings, carloads, from N. Y. C. & St. L. R. R. (N. K. P. district) stations in Ohio to destinations in Ohio. (b) To amend Item 1600 of above mentioned tariff, wherein is published equivalent table on limestone, agricultural, carloads, minimum weight 50,000 lb., from and to stations in Ohio, by eliminating reference to the L. E. & W. district now carried in connection with the N. Y. C. & St. L. R. R.

30722. To establish on dolomite, raw, and stone, fluxing (ex lake) (in open top cars only), in carloads (See Note 3), from Painesville and Perry, O., to Cleveland, O., rate of 80c per gross ton. Present, 90c, per N. Y. C., I. C. C., L. S. 1649.

30724. To cancel following rates on fluxing stone, carloads, as published in P. R. R. Tariff I. C. C. 58, viz., from Bellaire, O., to Bessemer, Penn., 139c; Columbus, O., 189c; Munhall, New Castle, South Duquesne, Penn., 139c; Zanesville, O., 151c per gross ton. (apply for P. R. R. delivery), account obsolete.

30729. To establish on stone, crushed, carloads, from Whitehouse, O., to St. Joe, 95c; Auburn, Garrett, Avilla, 100c; Albion, 105c; Kimmell, Cromwell, 110c; Syracuse, Leeland, Milford Jct., Nappanee, 115c; Bremen, La Paz Jct., La Paz, Ind., 125c per net ton. Present, class rates, except to Garrett, Ind., 138c per net ton.

30475. To establish on stone, crushed, stone screenings and agricultural limestone, carloads, from Milltown, Ind., to Loogootee, Ind., rate of 110c per net ton. Present, 16c.

30478. To establish on crushed stone, carloads, in open top equipment, from Bascom, O., to Me-

dina, O., rate of 75c (rate to apply via B. & O. direct). Present, 80c.

30740. To establish on crushed stone and crushed stone screenings, carloads, minimum weight from Bluffton, Ind., to Middlebury, Ind., rate 5c per net ton. Route: Via N. K. P.-Ft. Wayne, Ind., and N. Y. C. R. R. Present, 15c.

30742. To establish on agricultural limestone screenings, carloads, in open top cars, from Whitehouse, O., to points in Michigan, viz.: (Representative points) Pinckney, 110c; Munith, Jackson, 120c; Wixom, 115c; Bad Axe, 155c; Fowler, 135c; Grand Rapids, 155c; Flint, 125c; Attica, 135c; Lansing, 130c; Bellevue, Battle Creek, 145c; Kalamazoo, 155c; Marcellus, 165c; Middletown, 135c; Greenville, 145c; Sheffield, 145c; Harrisburg, 155c; Muskegon, 165 per net ton. Present—To Pickney, Munith, Jackson, Wixom, Bad Axe and Grand Rapids, class rates; Fowler, 145c; Flint, 135c; Attica, Lansing, 145c; Bellevue, 155c; Battle Creek, Kalamazoo, 165c; Marcellus, 175c; Middletown, 145c; Greenville, Sheffield, 165c; Harrisburg, 175c; Muskegon, class rate.

30748. To establish on sand, viz.: blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding and silica, carloads, from Glass Rock and South Zanesville, O., to B. & O. R. R. points, *Cambridge, O., and P. R. R. points, *Cambridge, O., Pleasant City, Caldwell, O., rate of 90c per net ton. Present—†Cambridge, Pleasant City, Caldwell, O., rate of 110c per N. Y. C. R. R. I. C. C. LS-1413.

*From Glass Rock, O., only.
†From South Zanesville, O., 90c.
Proposed rates to apply to open top equipment; the usual 115% basis to be applied when closed equipment is required.

30752. To establish on sand, gravel and crushed stone, carloads, minimum weight, to Delhi, Ind., from Keepport, 40½c; Peru and Lafayette, Ind., 50c per net ton. Route—Via Wabash Ry. Present, 70c per net ton.

30749. To establish on agricultural limestone, carloads, minimum weight 60,000 lb., from Genoa, Martin, Marblehead and Danbury, O., to points in the state of Michigan (representative points shown in Exhibit A attached), rates as shown in Exhibit A attached. Present—As shown in Exhibit A attached.

EXHIBIT "A"

From Danbury and Marblehead, O., to representative points in Michigan:

N. Y. C. R. R. stations		Prop. Pres. rate rate		Prop. Pres. rate rate	
Ottawa Lake	130	150	Onsted	145	160
Hillsdale	150	180	Ypsilanti	155	190
White Pigeon	170	200	Bankers	155	180
Kalamazoo	180	200	Brooklyn	150	180
Dorr	185	240	Deerfield	140	160
Grand Rapids	190	230	Monroe	135	150
Eaton Rapids	165	200	Detroit	150	160
Ann Arbor R. R.					
Dundee	142	150	Ithaca	187	230
Annperre	167	190	Cadillac	202	260
G. T. Ry.					
Owosso	187	200	Richmond	172	200
Marne	202	240	Randall Beach	172	200
Sparta	202	240	Owendale	192	260
South Lyon	177	190	Bancroft	182	200
M. C. R. R.					
Monroe	147	150	Findley	182	200
Marshall	177	200	Saginaw	192	230
Niles	197	230			
P. M. Ry.					
Waltz	152	160	Mt. Pleasant	197	250
Saginaw	187	230	Vassar	192	230
Benton Harbor	212	240	Helena	207	260
Twin Lake	212	240	Bay Port	197	260
Edmore	197	240			

From Genoa and Martin, O., to representative points in Michigan:

N. Y. C. R. R. stations		Prop. Pres. rate rate		Prop. Pres. rate rate	
Ottawa Lake	110	130	Onsted	130	150
Hillsdale	135	160	Bankers	140	160
White Pigeon	160	190	Brooklyn	135	160
Kalamazoo	170	200	Ypsilanti	140	150
Dorr	180	230	Deerfield	120	150
Grand Rapids	185	230	Monroe	115	140
Eaton Rapids	155	190	Detroit	135	160
Ann Arbor R. R.					
Dundee	127	140	Ithaca	177	220
Annperre	152	190	Cadillac	197	260
G. T. Ry.					
Owosso	177	200	Richmond	162	190
Marne	197	240	Randall Beach	162	200
Sparta	197	240	Owendale	182	260
South Lyon	167	180	Bancroft	172	200
M. C. R. R.					
Monroe	127	150	Findley	172	190
Marshall	162	190	Saginaw	182	220
Niles	187	200			
P. M. Ry.					
Waltz	132	160	Mt. Pleasant	192	250
Saginaw	177	220	Vassar	182	220
Benton Harbor	207	230	Helena	197	260
Twin Lake	202	240	Bay Port	187	260
Edmore	187	240			

*Genoa, O., 160c per net ton.

ILLINOIS FREIGHT ASSOCIATION DOCKET

6500. Sand and gravel, carloads (See Note 3), but not less than 60,000 lb., from Joliet, Ill., to Aurora and Minooka, Ia. Present rate, 63c per net ton; proposed, 50c.

5169-A. Sand and gravel, carloads, usual minimum weight, from Aurora, Ill., to Kankakee, Ill. Present rate, 101c per net ton; proposed, 88c.

6494. Refuse fuller's earth, carloads, minimum weight 60,000 lb., from Chicago, Ill., to La Salle, Oglesby, Utica and Dixon, Ill. Present, 12c per 100 lb.; proposed, 120c per net ton.

5169-A. Sand and gravel, carloads, usual minimum weight, from Aurora, Ill., to Kankakee, Ill. Rates per net ton: Present, \$1.01; proposed, 88c.

6500. Sand and gravel, carloads (See Note 3), but not less than 60,000 lb., from Joliet, Ill., to Aurora and Minooka, Ia. Rates per net ton: Present, 63¾; proposed, 50.

6523. Soapstone, refuse, crude, crushed, carloads, minimum weight 60,000 lb., from Joliet, Ill., to Chicago, Ill. Present, \$2.42 per net ton; proposed, 80c per 100 lb.

SOUTHWESTERN FREIGHT BUREAU DOCKET

24318. Slate, crushed or ground, from Arkansas points to Vandalia, Ill. To establish a rate of \$3.40 per ton of 2000 lb. on slate, crushed or ground, carloads, minimum weight 80,000 lb., or if marked capacity of car is less than 80,000, marked capacity of car will govern, from Mena, Caddo Gap, Norman and Glenwood, Ark., to Vandalia, Ill. (subject to Emergency Charges in S. W. L. Tariff 24). Receivers of freight at Vandalia, Ill., request establishment of rate made in relationship to the rate to St. Louis and Chicago for application to Vandalia. The commodity is to be used as an abrasive in the manufacturing of composition roofing and, it is stated, will be new movement from Arkansas producing points.

WESTERN TRUNK LINE DOCKET

4781-H, Sup. 1. Rock, asphalt, natural or coated, with not to exceed 5% of road oil, crushed or ground; stone, coated with not to exceed 5% of road oil, crushed or ground, in straight or mixed carloads, from Blue Rapids and Pleasanton, Kan., to all stations in Kansas. Rates—Present, class rates. Proposed—To establish on Kansas state traffic the mileage scale of rates on asphalt rock, etc., as described in Item No. 5 and as published on page 23, Rate Basis No. 10 of S. W. L. Tariff No. 162D. Minimum weight—present, classification minimum weight; proposed, 90c. (See Note 3.)

7881. Rates—Gravel, carloads (See Note 3), from Sampsel, Mo., to Cainsville, Mo. (mileage, 138.5). Rates—Present, 280c per 2000 lb.; proposed, 140c per ton.

2556-Y. Sand and gravel, carloads (See Note 2), but not less than 40,000 lb., from Hager and Maiden Rock, Wis., to Missouri River points, Indices 1 to 22 as shown in first section of Item 2160C, Supplement 32 to W. T. L. Tariff 1-S. Rates: Present—As shown in Item 2160C of the above tariff. Proposed, 15½c per cwt.

2556-Z. Sand, carloads (See Note 2), but not less than 40,000 lb., from Hager and Maiden Rock, Wis., to Racine and Beloit, Wis. Rates—Present, \$1.90 per net ton. Proposed, \$1.70.

I. C. C. Decisions

23625. Fluxing Stone. Examiner Frank C. Weems, in 23625, rates on raw dolomite and fluxing stone within the state of Ohio, 23832, Marble Cliff Quarries Co. vs. Pennsylvania et al. and a sub-number, Weirton Steel Co. vs. Same, has proposed a revision of rates on the commodities mentioned, state and interstate, to remove unreasonableness, undue prejudice, and unjust discrimination against interstate commerce. The title proceeding was instituted by the Commission in August, 1930, on account of intrastate rates prescribed by the Ohio commission in May, 1929. The commodities involved in the proceeding are used very largely by iron furnaces. The institution of the title proceedings was caused by petitions of railroads operating in Ohio. A rate of \$1.05 a long ton from stone-producing points in northern Ohio to Alliance, Bentley, Girard, Hubbard, Leetonia, Lowellville, Newton Falls, Niles, Struthers, Warren and Youngstown, Ohio, was the chief point of attack. Rates to other iron and steel points were related to it, the rate to

Youngstown, for instance, being 80c a ton.

The chief premise of the carriers' petition concerning the rate of \$1.05, according to the report, was that it was substantially less than a rate of \$1.26 from the same producing points in northern Ohio to Sharon, Farrell, Sharpsville, West Middlesex and New Castle, Penn., all furnace points in the Shenango Valley in Pennsylvania. The Ohio rate to Youngstown and other points in the Mahoning Valley in Ohio was alleged to prefer the Ohio plants unduly and to constitute unjust discrimination against interstate commerce. Examiner Weems said the Commission should dispose of the matter by findings as follows: 1. That the Ohio intrastate rates do not cause any undue prejudice or unreasonable advantage, preference, or prejudice as between persons or localities in intrastate commerce on the one hand or interstate commerce on the other hand, or any undue, unreasonable or unjust discrimination against interstate commerce, and are not otherwise unlawful, except in respect of the rate from Marble Cliff to Steubenville and Mingo Junction, Ohio;

2. That the rate of \$1.13 on fluxing stone, in carloads, from Marble Cliff to Weirton is reasonable.

3. That the maintenance of the rates of \$1.05 from Marble Cliff to Mingo Junction and Steubenville and \$1.13 to Weirton results in undue preference of intrastate consumers in Ohio and undue prejudice to the Weirton Steel Co., complainant in No. 23832 (Sub-No. 1) engaged in interstate commerce, in that there is a difference in the rates on fluxing stone, in carloads, from Marble Cliff to Weirton on the one hand and Steubenville and Mingo Junction on the other hand. The undue prejudice should be removed by increasing the intrastate rates.

4. That with reference to No. 23832 the rates assailed are not unreasonable, and that the allegation therein of undue prejudice has not been sustained. Complaint dismissed.

As stated, the interstate rate from Marble Cliff to Weirton was increased 6c per ton of 2,000 lb. on January 4, 1932, pursuant to the decision in Ex Parte 103, The Fifteen Per Cent Case, 1931. The record in the instant proceedings discloses no justification for a difference in the rates from Marble Cliff to Weirton on the one hand and Mingo Junction and Steubenville on the other. However, the record in the instant proceedings was closed prior to the decision in Ex Parte 103. In the circumstances the Commission may not require a parity of rates from Marble Cliff to Mingo Junction, Steubenville and Weirton, but there is no justification for the maintenance of rates from Marble Cliff to Mingo Junction and Steubenville lower than the rate contemporaneously maintained from Marble Cliff to Weirton, not inclusive of the increase of 6c per ton of 2,000 lb., effective January 4, 1932.

New Organization Adds Two Units

UNITED MATERIALS CORP., Milwaukee, Wis., has announced acquisition of the F. A. Becker Co., sand and gravel producers of North Milwaukee, and the Pipkorn Marggraff Co., building supply dealers. The United Materials Co. is composed of 16 building material dealers, with more to be included shortly, it is reported.—*Milwaukee (Wis.) News.*

Annual Meeting of American Concrete Institute

Concrete Institute Program Discusses Subjects
Covering the Entire Field of Cement and Concrete

THE 28th annual convention of the American Concrete Institute, held in Washington, D. C., March 1-4, was notable for the strong and diversified program presented. While the attendance was adversely affected as a result of prevailing conditions, those who attended showed active interest in the many phases of concrete and masonry materials which were discussed.

The report which follows covers those papers and discussions of interest and value to producers of cement, aggregates, and the related nonmetallic minerals involved in concrete and masonry mortars.

Volumetric Changes in Neat Cements and Mortars

In a paper, "Volumetric Changes in Neat Cements and Mortars," R. E. Mills, research assistant, engineering experiment station, Purdue University, gave results of tests begun in 1924 concerning volume changes in small molded beams composed of neat cements and mortars of various kinds. Portland cements common to Indiana were used in the investigations during which 3500 volume change observations were made.

Two sets of neat cement specimens were studied, one being exposed to the air over a period of about 7½ years and the other immersed in water for 6½ years after a preliminary exposure to air for 200 days. Volume changes of the first set due to loss of moisture showed a contraction of from 0.112 to 0.26%, with a maximum during the spring of 1929. Changes followed the seasons and were dependent upon the relative humidity. Contraction was greater in winter, reaching a maximum during early spring. Expansion occurred during summer, attaining a maximum in early fall. Slight indications of growth were observed over the 7½-year period.

Specimens for the second series of tests on neat cement were exposed to the air for 200 days after which they were immersed in water. Contraction during the initial period of air curing was 0.06 to 0.15%. The specimens expanded in water, however, with a maximum change of from 0.21 to 0.27% and even now show slight continuing growth.

Tests on mortars were conducted in the same manner as regards laboratory procedure, but the specimens were immersed

Editor's Note

THE PROGRAM of the American Concrete Institute was planned so as to present information of interest and value to every member. This report is limited to those transactions of interest to the rock products industry. In this respect many interests are covered. Besides cement and aggregates, the discussion of masonry cement and of the workability of concrete is of interest to the lime manufacturer and to a large group of producers of miscellaneous materials used in an effort to better the inherent properties of concrete. Concrete products, too, received much consideration at the various sessions.

in water and exposed to air during cycles of 120 days, two and one-half cycles having been completed to date.

Patented cement mortars showed a cumulative shrinkage, portland cement mortars indicated a slight residual shrinkage, whereas lime-cement mortars revealed a cumulative growth which seemed to be proportional to the lime content. The contraction of the patented cement mortars at the end of the saturation period was 0.061 to 0.114%, that of the portland cement was 0.02% whereas the cement-lime mortars expanded 0.071 to 0.107%.

On Masonry Cements

A paper, "Properties and Problems of Masonry Cements," by J. C. Pearson, director of research, Lehigh Portland Cement Co., was abstracted by him. In this paper, Mr. Pearson said "masonry cements have properties that are in general characteristic of mixtures of portland cement and lime" and that "since neither portland cement alone nor lime alone makes a good masonry cement for general use, and since there is no reason why other materials than cement—lime mixtures should not make good masonry cements, there has long existed an opportunity for manufacturers to produce masonry cements as a finished product and to put them on the market in competition with . . . other cements largely used for this purpose.

Mr. Pearson pointed out the wide variations in the several mortars now avail-

able. He then described the survey which he conducted to enable him to set up a measure of the relative value of the various properties of masonry cements. Through this survey he set up the following properties listed according to their relative importance.

These properties as determined were: Plasticity or workability; volume change; weather resistance or durability; bond strength or adhesion; elasticity or flexibility; rate of stiffening; efflorescence; impermeability; strength; and staining, fading, etc.

In his investigation, Mr. Pearson studied mortars having the following proportions by weight:

Cement	Lime
100%	0.0%
87.5%	12.5%
75.0%	25.0%
62.5%	37.5%
50.0%	50.0%

In this study plasticity or workability of the mortar increased with increasing quantities of lime.

No definite conclusion was reached on volume change. Differences of opinion were pointed out regarding various theories as to whether the shrinkage of a paste or mortar coat in a water-tight mold is a function of the shrinkage of the same paste or mortar cast in an absorptive mold, under the same condition of test in both cases.

He said bond strength or adhesion was a desirable property and pointed out the value of a thorough analytical study of this to develop more essential data.

The importance of weather resistance and durability are overrated, according to Mr. Pearson, as the lack of durability may be the result of poor workmanship or some combination of undesirable plasticity or volume change characteristics rather than lack of durability in the mortar itself, he stated.

On the matter of elasticity he referred to the researches now being conducted by the Bureau of Standards. Proper precautions against efflorescence require tests of all materials. It was said that addition of water-repellant admixtures to cements has been generally recommended. In commenting on impermeability he advocated the use of stearates to reduce absorption.

In considering the value of various strength tests, conclusions based on tests

were that: (1) the greatest range in strengths is shown in the bulk volume basis of proportioning; (2) paste volume proportions give a somewhat smaller range, in strengths than the bulk volume proportions; (3) weight and absolute volume proportions give nearly identical strengths, favoring weaker cements, as compared with bulk volume proportions; and (4) the best choice for testing purposes, all things considered, lies between weight proportions and bulk volume proportions.

Discussion of Masonry Mortars

W. D. M. Allan, in a discussion of this paper, presented data to show the effect of strength of mortar upon wall strength. He showed the need of mortars of various strengths for different types of masonry and for different applications in construction.

Lee S. Trainor, chief engineer, construction division, National Lime Association, referring to the statement that "neither portland cement alone nor lime alone makes a good masonry cement for general use," cited various structures in Mexico, in Europe and the United States on which straight lime mortar was used with satisfactory results.

Dr. F. O. Anderegg, Mellon Institute, said that his views coincided with those expressed in Mr. Pearson's paper regarding the development of a satisfactory masonry cement.

A. T. Malmel, president, Hy-Test Cement Co., Philadelphia, thought that the Portland Cement Association had placed too much emphasis on high mortar strengths and that plasticity and workability is now being over-emphasized by the National Lime Association. He suggested that a more thorough examination of local masonry would bring out interesting facts concerning the matters under discussion. He also said he felt that too much emphasis was being placed on the properties of mortars; that other factors should receive more.

A. T. Goldbeck, director of the bureau of engineering, National Crushed Stone Association, in the absence of **F. C. Lang**, chairman, committee 902, presented a proposed specification for concrete pavements for municipalities. Changes in the specification as suggested by the committee would call for a maximum loss by decantation of coarse aggregate of 1%.

Tells of Iowa's Success With Mortar Void Method of Design

R. W. Crum, director, Highway Research Board, in the absence of **Mark Morris**, Iowa State Highway Commission, gave an abstract of Mr. Morris' paper on the "Mortar Voids Method of Designing Concrete Mixtures." The paper reviewed the experience of the Iowa Highway department with this method

since 1927, during which time several hundred miles of concrete pavement have been placed. Mr. Crum stated the degree of success obtained in the use of this method confirmed the belief that it is a sound basis of design. Test results showed remarkable uniformity and agreement of results with original estimates.

He reported that in Iowa it was found more satisfactory to determine mortar void characteristics of all sands rather than to take a general curve and make correction for different sands. The excellent quality of the concrete obtained and the increase in quality was shown by the average compression values for three years: 4278 lb. per sq. in. in 1929; 4696 lb. per sq. in. in 1930; and 5108 lb. per sq. in. in 1931. This increase might be attributed to better cement, improvement in aggregates and improvement in testing.

He illustrated the accuracy with which estimates were made. In one instance, with a water-cement ratio of 5.4 gallons of water per bag of cement, the absolute volume of cement required was estimated as 0.1085. The amount actually used was 0.1092. The absolute volume of solids required was estimated at 0.8353 and 0.8329 was actually used. In estimating cement requirements 1.528 bbl. were estimated as required and 1.536 bbl. were used per cu. yd. of concrete.

This accuracy was carried through in the resulting strengths. Concrete was designed for a 28-day compressive strength of 4000 lb. per sq. in. One group of 50 samples tested 4170 and another group 4109 lb., while pavement cores taken at from 40 to 75 days averaged 4370 lb. per sq. in.

Compressive Strength Alone Does Not Indicate Quality of Concrete

F. H. Jackson, U. S. Bureau of Public Roads, in commenting on this paper, pointed out that failures in concrete seldom occur in compression. The greatest value of compressive tests is that concrete with good compression strength frequently is satisfactory in other respects. There are certain aggregates which will give satisfactory compressive strengths but which are unsatisfactory in flexure. Some high strength aggregates will give 30% higher flexural strengths than other aggregates. He cited one instance where it was necessary to use seven bags of cement, whereas a stronger aggregate produced satisfactory results with six bags. By the use of the mortar void method of design alone Mr. Jackson said widely varying flexural strengths might result. He said this condition might be anticipated in various areas, though perhaps to a lesser extent in Iowa. He recommended the water-cement ratio method be used.

F. E. Richart, professor, materials testing laboratory, University of Illinois, said

the mortar voids method had been used by the Illinois state highway department in recent years and that it had established a minimum flexural strength requirement at 14 days of 650 lb. The average strength obtained during the first year was 690 and during the second year 788. He attributed the increased strength to higher quality cement and greater care in testing.

Dr. Duff A. Abrams, consulting engineer, New York City, asked to what Mr. Jackson attributed the extreme variance in strength results which he had reported with different aggregates. It was explained that such variations were attributed to those characteristics of the aggregate which affect the bond of cement with the surface of the aggregate.

Mr. Crum said flexural tests as well as compressive tests could be applied to concrete designed by the mortar void method and that he could see no variance between the mortar void method and the water-cement method.

S. C. Hollister spoke of the progress in design of concrete that has taken place in highway work and urged structural engineers to be alert to this progress.

Workability of Concrete

Franklin R. McMillan, director of research, Portland Cement Association, in the absence of **T. C. Powers**, associate engineer of the association, read a paper on "Studies of Workability of Concrete," which defined workability as that property of a plastic concrete mixture which determines the ease with which it can be placed, and the degree to which it resists segregation. The study showed that the principal factors to be considered were the quantity of paste, the characteristics of the paste and the type and gradation of aggregates.

The method of testing, called the remolding test, was described and is discussed in detail on pages 37 and 38 of this issue. The following are among the conclusions drawn from the investigation:

1. Mobility of a concrete mixture increases with paste content when the aggregate gradation is constant, except for very fluid pastes or the coarser gradations.

2. Stiffening the consistency of the paste may either increase or decrease the mobility of the concrete depending on the gradation and initial consistency of the paste, with aggregate gradation and paste content fixed.

3. It appears that with constant paste content, paste consistency and aggregate gradation, the kind of materials of which the paste is made is of but secondary importance.

4. With constant paste content, increasing the percentage of sand decreases particle interference and stiffens the mix.

5. There is an optimum percentage of sand which requires the least quantity of

paste for each water-cement ratio, gradation of coarse aggregate and degree of mobility.

6. For combinations of three sizes of coarse aggregate (No. 4- $\frac{3}{8}$ in., $\frac{3}{8}$ - $\frac{3}{4}$ in., and $\frac{3}{4}$ -1 $\frac{1}{2}$ in.) changing the ratio between the last two sizes over a wide range made no difference in cement requirement, provided the optimum percentage of sand and pea gravel for each particular combination was used.

7. It is important to design mixes to suit available materials.

8. Some "gap" gradings appear to be fully as economical as uniform or continuous gradings when combined with the proper percentage of sand.

9. The gradations requiring the least cement at a constant water-cement ratio are not necessarily those having the least voids in the mixed aggregates.

10. Crushed coarse stone aggregate requires higher percentages of sand and more cement for a given remolding effort than rounded gravel of the same gradation, preliminary tests indicate.

11. The remolded test is suggested where precise designing of mixes is an advantage.

G. A. Smith, of the Johns-Manville Research Laboratories, Manville, N. J., then showed illustrations to demonstrate the close relation between results obtained by the method described in Mr. Powers' paper and the penetration method, with which he has carried on extensive tests.

R. B. Young, consulting engineer, Toronto, Ont., Canada, said tests he had made by another method checked the results of Mr. Powers on the relation of remolding effort to paste content and slump; also between paste content and percentage of sand in the aggregate.

P. H. Bates, United States Bureau of Standards, questioned certain terminology of the paper. The discussion of the paper was lively and brought forth some caustic comment.

Tests of Transit-Mixed Concrete

S. C. Hollister, professor of structural engineering, Purdue University, read a paper, "Tests of Concrete from a Transit Mixer." The paper discussed a test on Jaeger truck-transit mixers, the purposes of which were to determine the relation between the strength of the concrete and the time of mix; the relation of the time of mix and the degree of uniformity of the concrete produced; and the relation of other observable features of the mixing operations to both strength and uniformity of output.

In charging the mixer, aggregates were "ribboned" into the drum, water was added through the charging door, and finally cement was placed directly on top of the aggregates in the drum as it was felt this would be common procedure in the field.

The following conclusions were drawn from the test data:

1. "For practical ranges of mixtures, and regardless of mixer speed, 40 revolutions of the drum adequately mix the batch when the charge is introduced by ribbon loading, and 60 revolutions of the drum properly mix the batch when the charge is placed by laminated loadings.

2. "The speed of the mixer appears to have no effect upon the thoroughness of mixing or upon the strength obtained for mixing periods of 40 rev. or more when the charge is placed by ribbon loading.

3. "So long as the mix remains workable there appears to be no variation in strength for mixing periods varying from 40 rev. of the drum to 1 $\frac{1}{2}$ hr. of mixing.

DISCUSSIONS of papers occupied an important part of the meeting. Papers which developed the most lively discussions were on masonry mortars, the workability of concrete, and of transit mixing of concrete. Interesting discussion also followed the paper on the mortar void method of designing concrete.

Tests were not conducted beyond the latter period.

4. "There appears to be a regular relation between strength of concrete at 7 and 28 days and water-cement ratio. The relation appears to be of the same form as for other usual methods of mixing. The strengths, however, seem to be somewhat above those commonly obtained with the usual one minute of mixing.

5. "Tests show that where water was added during mixing to improve workability, the strength of the regaged concrete bore the same relation to the water-cement ratio after regaging as though the mixture had originally been made with that water-cement ratio.

6. "Overloading of this transit mixer required special charging methods and a longer minimum mixing time than 40 rev. of the drum."

Mr. Hollister also added that the result of this study cannot be applied to other equipment without further study.

Much Discussion Follows Paper

In discussing this paper **Frank I. Ginsberg**, vice-president, H. O. Penn Co., New York, N. Y., brought out the fact that concrete that has lost its workability can be brought back by adding water; also that premixing concrete 45 sec. before a run of 15 min. gives increased strength.

Cloyd M. Chapman, consulting engineer, New York, N. Y., pointed to the need of calling for different physical requirements of concrete. He said dense concrete provides all the elements of high

quality in concrete and called attention to the undesirability of having air in concrete. It was his opinion that violent churning resulting from mixing tended to increase the amount of air in the concrete. He felt that thorough mixing and conditioning, which might also be considered deaerating, were two important operations possible with ready-mixed concrete.

Mr. Chapman pointed out that Prof. Slater's study of the Clinton mixer showed that the strength of concrete was doubled with increased mixing time whereas Prof. Hollister showed little increase in strength with the Jaeger mixer after 40 to 60 rev. of the mixing drum. He considered that a mixer that would give maximum strength with 40 rev. would overdo the mixing operation by continued mixing.

Prof. Hollister stated that the Jaeger mixer did not increase the air in the concrete and may have decreased it. The Dunagan test also showed that no large quantity of air was held in the concrete. Since the speed of the mixing drum varied between 5 and 20 r.p.m. for the 2 $\frac{1}{2}$ -yd. size, he said, no violent churning resulted.

Mr. Chapman asked for a comparison of the results of concrete made in ordinary mixers and in transit mixers. Prof. Hollister said he had omitted this information from his report because he felt the results were not sufficiently complete to warrant conclusions. The tests so far completed would indicate strength of transit mixed concrete at 7 days equal to 28-day concrete produced in ordinary mixers.

A. A. Levison, chief engineer, Blaw-Knox Co., Pittsburgh, Penn., said transit mixing equipment was very different from ordinary mixing equipment. He said increase in strength of concrete might be expected as the time of agitation increased and referred to results of a test continued for nine hours which showed a 3% increase in strength with 20 min. of mixing; 5% increase at 40 min.; 10% increase at 2 hr.; 12% increase at 3 hr.; constant strength from 3 to 7 hr.; and retrogression in strength from 7 to 9 hr.

Lion Gardiner, vice-president, Lakewood Engineering Co., Cleveland, Ohio, said he could find no divergence in results between Prof. Hollister's and Prof. Slater's investigations.

Russell S. Greenman, consulting engineer, Albany, N. Y., said stiffening of the concrete indicates air is removed, rather than added. He had noted a difference in yield of concrete and believed that a comparison of yield and weight would indicate changes in air content of concrete. Prof. Hollister reported all specimens were weighed and that no variation in excess of 1% was found; also

that these variations were traceable to defects in the cylinders.

Papers of Interest to Concrete Products Manufacturers

Several papers at the meeting were of interest to concrete products manufacturers. A subject of much interest to products men is high pressure steam curing and this was discussed by **J. C. Pearson**, director of research, and **Edward M. Brickett**, Lehigh Portland Cement Co. It presented preliminary studies of high pressure steam curing.

Producers of aggregates used by the concrete products industry should be familiar with this development because the results of this investigation indicated that behavior of the aggregates used in high pressure steam curing did not always parallel results attained over longer periods of normal curing, and that materials used in quick curing practice under relatively high steam pressures may have to be selected with certain precautions which are not necessary when cured under normal conditions.

These tests of the effect of time and pressure in the region of 80 lb. per sq. in., were carried on in an autoclave in which the specimens were suspended in saturated steam at various pressures and temperatures. In general, compressive strengths of 6000 to 7000 lb. per sq. in. were obtained by steaming for 18 hr. or longer at pressures of 100 lb. per sq. in. or higher. Results indicated that equivalent strengths could be obtained by curing for a short time at high pressures or for a longer time at lower pressures.

Studies were also made of the various effects of type of cement, cement content, consistency of the mix, age before steaming and type of aggregate.

High Pressure Curing Affects Aggregates Differently

An interesting and perhaps significant effect of the type of aggregate used was brought out in certain specimens containing aggregates of dolomite, calcite, marbles and limestone. The specimens, high in carbonates, showed lower strengths when cured under high steam pressure as compared with specimens containing such materials as Delaware sand and gravel or trap rock. Similar specimens with calcareous aggregates gave satisfactory results after a 7-day curing period in the damp room under usual conditions. Two specimens containing lightweight aggregates indicated satisfactory strengths with accelerated curing.

In conclusion the authors pointed out the possible advantages of high pressure steam curing as producing products with higher strength and lighter color, the elimination of volume changes, appreciable reduction of defects such as crazing and cracking, products completely

cured in 48 hr. or less after making, control of such properties as porosity and nailability; and economy in cement.

The chief disadvantages are: Comparatively high investment for high pressure equipment; somewhat higher cost of curing; and some restrictions in the use of materials considered satisfactory for concrete cured under normal conditions.

Performance of Masonry in Walls

F. E. Richart, professor, materials testing laboratory, University of Illinois, read a paper on the structural performance of concrete masonry walls. The paper presented data from a series of tests on walls, with an interpretation of their engineering significance. The conclusions based on these tests were:

1. "The compressive strength of large wall panels apparently depends mainly upon the strength of the building units. The average ratio between strength of wall and strength of unit was found to be 0.53.

2. "The ratio between compressive strengths of large walls and wallettes was fairly constant, with an average value of 0.91.

3. "The factor of safety of walls in compression, based upon working stresses of 70 and 80 lb. per sq. in. varied from 4.4 to 11.5.

4. "The compressive strength of 8-in. walls of 3-oval core units with face shell bedding was about 80% of that obtained with full bedding. The flexural strength was approximately the same for the two cases.

5. "A range in modulus of elasticity of walls from 300,000 to 1,170,000 lb. per sq. in. of gross area was found. The deformation of walls at working stresses is apparently less than for compression members of steel or reinforced concrete.

6. "Composite walls of face brick and concrete units developed high strengths and showed satisfactory interaction of the two materials, though there were large differences in deformations in some cases.

7. "Walls under eccentric compressive loads applied at the edge of the middle third of thickness deformed very consistently and developed strengths about three-fourths as great as did axially loaded walls.

8. "The flexural strength of walls depended upon the adhesion of mortar to unit, with failure following a horizontal mortar joint. Moduli of rupture observed varied from 18 to 50 lb. per sq. in."

Effect of Mortar Strength on Wall

H. F. Gonnerman, manager, research laboratory, Portland Cement Association, read a paper prepared by **R. E. Copeland**, engineer, cement products bureau, and **A. G. Timms**, associate engineer, research laboratory, Portland Cement Association on "The Effect of Mortar

Strength on the Strength of Concrete Masonry Walls." The paper reported the result of tests of concrete masonry wall-ettes constructed of one design of unit but having different strengths, three types of aggregate and six different mortars. The conclusions are based on values determined for walls 9 ft. high and are as follows:

1. For a given mortar, the strengths of the walls was directly proportional to the strength of the individual units.

2. The type of aggregate used in making the units had little, if any, influence on the strength of walls, except as it affected the strength of the units themselves.

3. If the potential strength of the units is to be realized in the wall, the mortar used in laying up the units must at the time of test be at least as strong as the units themselves.

4. Units within the usual commercial range (700 to 1000 lb. per sq. in.) produced wall strengths ranging from 340 to 665 lb. per sq. in. or $4\frac{1}{4}$ to 8 times the maximum stress of 80 lb. per sq. in. permitted with this type of construction when portland cement mortar is used. The use of stronger units increased the wall strength proportionately. With the strongest units, a wall strength of 2880 lb. per sq. in. was obtained which would give a factor of safety of 36.

Tells of Fire Tests on Concrete Masonry Walls

C. A. Menzel, Portland Cement Association, described fire tests of concrete masonry walls and discussed the "Strength of Concrete Masonry Walls After Standard Fire Exposure." The conclusions reached in this paper were:

1. The compressive strength of concrete masonry walls, both before and after exposure to fire, was directly proportional to the original compressive strengths of the units.

2. The strength of walls, tested without exposure to fire and constructed of units of a given design and strength, was independent of the type of aggregates, depended to some extent on the type of mortar, but depended mainly on the type of mortar joints and character of mortar bedding. However, after exposure to fire, the wall strength was influenced to a more marked degree by the type of aggregate than by the type of mortar but to an even greater extent by the type of mortar joints and character of mortar bedding.

3. Closely similar strengths were obtained from walls laid up with units of a given strength with portland cement—lime mortars ranging from 1-1-6 to 1-0-15-3, both before and after exposure to fire. When the cement content of the mortar was reduced below that of a 1-1-6 mix there resulted a decrease in wall strength which was approximately pro-

portional to the decrease in the cement content of the mortar.

4. The strength of walls plastered on either the exposed face or on both faces was apparently higher after fire exposure than unplastered walls.

5. No outstanding advantage was discernible in wall strength after fire exposure for one design of unit over another in tests of walls of the same thickness.

6. An outstanding feature of the investigation was the substantial load-carrying ability and safety exhibited by the walls, before, during and after severe fire exposure.

7. The tests provide basic information for the manufacture of concrete masonry units from a wide range of available materials, and for their assembly into walls which will meet the most exacting strength requirements.

Another paper of value to the products manufacturer was given by **Fred R. Lear**, professor, architectural design, Syracuse University, on "Cast Stone as a Means to Color in Architecture." Mr. Lear discussed the growing importance of color as an architectural medium in building materials. He illustrated various harmonious applications of color in building exteriors and said cast stone offered an excellent material through which architects might express their creative ideas.

Many of the visitors enjoyed the special trips which were arranged for their entertainment. The first of these was a trip to inspect the work of John Early. A trip to the Bureau of Standards and to the Bureau of Public Roads showed the broad scope of the work which they are carrying on for the rock products industry. Also of interest was the trip to the Arlington National Cemetery by way of the Mt. Vernon Memorial Highway.

Elect Officers

The following officers were elected: President, S. C. Hollister, professor of structural engineering, Purdue University; vice-president, Arthur R. Lord, consulting engineer, Chicago; treasurer, Harvey Whipple. R. B. Young, Toronto, and Prof. Raymond E. Davis, University of California, were reelected directors and John G. Ahlers was a newly elected director.

Brand New Concrete Product!

BACK-YARD GARDENS ultimately may be paved instead of plowed.

The United States Department of Agriculture is now experimenting with permanent mulches of concrete, iron, cinders, zinc, aluminum and other substances, which cover the surface of the ground, except for a small space where the plants grow.

The experiments, an outgrowth of the successful paper-mulch investigations of recent years, are as yet in their infancy, and the

department makes no predictions as to their final value. In the tests beans, peas, strawberries and various other small fruits have grown as well under the permanent mulch as with ordinary cultivation.

Blocks a few inches thick and 9 and 12 in. wide cover the ground, with rows 1½ in. wide between them. The permanent mulch conserves moisture and controls weeds. In addition it warms the soil earlier in the season and keeps it warm longer in the fall. Rainfall gets into the ground along the rows between the blocks. The cinder blocks are covered with asphalt to make them black and absorb more heat, and other materials are painted black.

Soil covered with the blocks since 1928 have continued productive. Government scientists believe it possible that no ill effects will be found, because they know that trees grow successfully under city streets and sidewalks, which constitute a "permanent mulch."

The Japanese, in certain parts of their country, grow strawberries by using field stones and cement blocks on the ground between the plants, but these are on mountain sides and are placed on a slant. The chief purpose is to force the plants for the mid-winter market, and the system has been in use for several years.

Reports Quick Acceptance of Ready-Mixed Concrete

ANOTHER interesting report of the rapid growth being enjoyed by the ready-mixed concrete industry is made by the Graham Bros. Co., Long Beach, Calif.

The first of the year it bought five "Jaeger" truck mixers from the Smith Booth Usher Co. of Los Angeles and is reported already to be planning to extend its operations, in order to meet the demands.

It is interesting to know that the Western Motor Transfer Co., Santa Barbara, and the Service Gravel Co., Riverside, have had this same service installed for several months with satisfaction to all of their contractor customers.

New Ready-Mix Concrete Business in Los Angeles

THE Consolidated Rock Products Co., Los Angeles, Calif., largest producer of aggregates in southern California, is preparing to go into the ready-mixed concrete business on a large scale. It has a number of bunker and distribution yards in various parts of the city from which it has distributed aggregates. These will now be used as centers for distributing ready-mixed concrete.

Permanent plants will be built at two of these. Semi-portable plants will be built at some of the others, the idea being to make permanent plants of those which develop sufficient business to justify it. Transit mixer bodies of the type which has a sepa-

rate motor to run the mixer have been purchased. And it is expected that this system will be used throughout. Sand will be received in bulk and stored in steel tanks.

This new department of the Consolidated's business will be in charge of H. D. Jumper, the company's engineer, as a branch of the operating department of which L. L. Rogers is manager. Mr. Jumper will have for his assistant James Ulery. Mr. Ulery has been connected with the ready-mixed concrete business in San Francisco for some years.

Waterproofing and Admixture Association

PRODUCERS of pumice, pumicite, diatomite, tripoli, bentonite, talc, and soapstone may be interested in a new concrete waterproofing and admixture association which is being formed.

The organization, proposed a year ago at the meeting of the A. C. I., was conceived at a conference of manufacturers in Cleveland, December 15, 1931, and has taken more definite shape during recent meetings of the 28th annual convention of the American Concrete Institute, at Washington, D. C., March 1-4. The purpose of the association is to clarify the whole concrete admixture situation and to gain for such products approved classification and to set standards regarding performance and use.

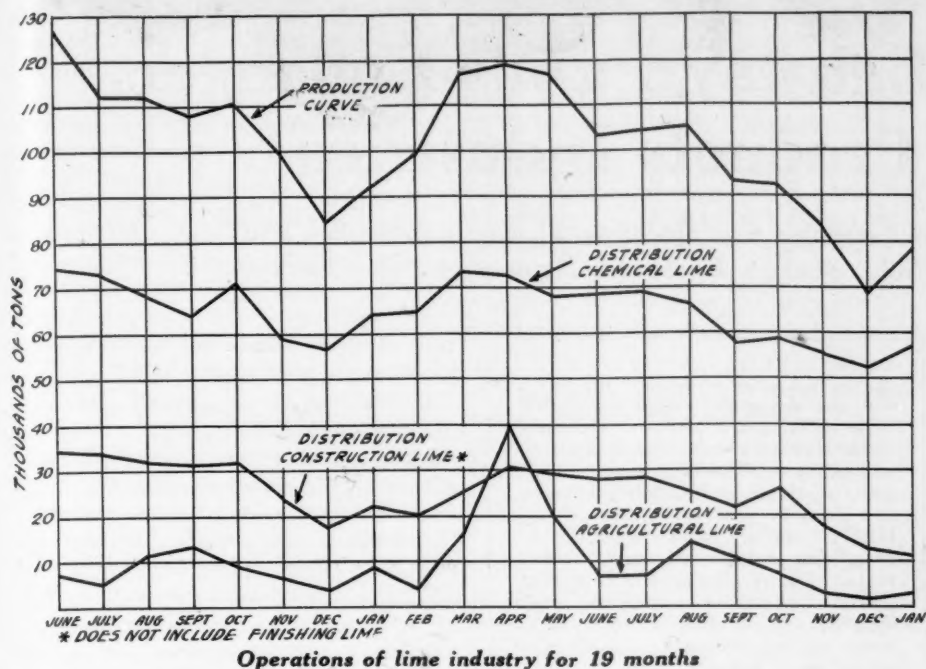
The association will endeavor to secure more general recognition in the construction industry of the merits of admixtures. The various admixtures are to be classified and test data assembled so that, eventually, specifications can be set up which will be recognized by the A. S. T. M. and the A. C. I. and will be acceptable to manufacturers and producers as well as to architects, engineers, and contractors. To carry out this program, the active cooperation of all producers and manufacturers of admixtures is essential.

Smoke Abatement

APAPER, "Rationalizing Smoke Abatement," was read at the conference on bituminous coal held at the Carnegie Institute. The paper was by Victor J. Azbe, consulting engineer, St. Louis, Mo., who is chairman of the research committee of the Citizens Smoke Abatement League of St. Louis. The paper discussed in detail the cause of smoke and its prevention.

Permissible Explosives and Blasting Devices

THE BUREAU OF MINES has issued a bulletin listing official changes in the active list of permissible explosives and blasting devices for January, 1932. Included in this list are Austin Red Diamond No. 1, L. F. manufactured by the Austin Powder Co., Cleveland, Ohio, and Gen-Gel No. 2, manufactured by General Explosives Corp., Latrobe, Penn.



Production and Distribution of Lime

THE ACCOMPANYING CHART shows statistics of operations in the lime industry for a 19-month period ending with January, 1932.

This information, supplied by the National Lime Association, represents 50% of the total lime production of the country. Reasonable accuracy in estimating total production should be obtained from it by doubling the amounts shown in the chart.

Indiana Quarry to Add Equipment

THE BLUE CREEK Stone Co., with quarries in Adams county, Indiana, has been sold to the Meshberger Bros. Stone Co. of Linn Grove.

The quarry produces a white limestone and has been in operation 10 years. Stone is quarried at a depth of about 36 ft.

The new owners will install additional equipment at the quarry and plans have been made to produce at least 100,000 tons of stone a year.—*Decatur (Ind.) Democrat*.

To Develop Quarry and Sand Pit

DEVELOPMENT of building sand and rock deposits near Visalia, Calif., is indicated by the leasing of the Parker sand pit to J. T. Degnan of Hanford. He has also secured control of the Venice Cove rock quarry. The local rock is declared to be the only rock, outside of that quarried at Piedra, that will be accepted by the state for asphaltic concrete highway construction, produced in the San Joaquin Valley.—*Fresno (Calif.) Bee*.

Zoning Against Rock Products Plants

A PETITION has been given the North Hollywood, Calif., city council requesting that the petition of Burbank Rock Products Co. for permit to establish additional bunkers on a parcel of land northerly of Victory boulevard and Vineland be denied. It was referred to the planning committee.

A further step to stop the invasion of rock crushing plants throughout the valley was seen in a resolution from Councilman Randall, asking that the residential district ordinances be amended to include the property known as and being adjacent to Remsen and Montague streets, comprising the major portion of the San Fernando valley, in the residential district zone. The matter was referred to the city planning commission.—*North Hollywood (Calif.) Press*.

Guide to Safety Council Services

THE National Safety Council, Chicago, Ill., has issued Part II of the *National Safety News* for February. This part is entitled "A Guide to the National Safety Council's Services," and presents a complete review of the many services which the Safety Council extends.

Stone Plant Proposed in Missouri

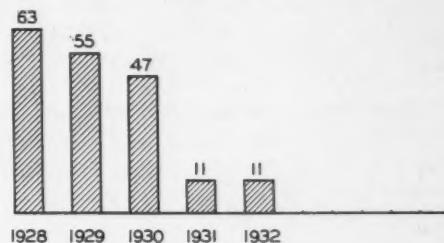
A STONE CRUSHING plant to be located near Cassville, Mo., has been proposed by James Rich, contractor. It was stated that when completed the plant would have a capacity for crushing about two to four cars of stone a day.—*Springfield (Mo.) Press*.

January Accidents

NINE lost-time and two fatal accidents occurred in the member mills and quarries of the Portland Cement Association during the month of January, as compared with 12 lost-time accidents and one fatality in the same plants during December. There were 11 lost-time and no fatal mishaps in this operating group during January, 1931.

One of the fatal accidents of the past month occurred in connection with manufacturing operations, while the other was chargeable to new construction. In the former, a laborer employed at the crusher plant complained of a severe headache, presumably as a result of a stick of dynamite exploded in the crusher. The headache continued for 12 days, at the end of which period symptoms of meningitis developed. The injured died three days later.

Report of the second fatal accident shows that two workmen placed a scaffolding, supported on two 4 by 4's on chains, above moving machinery consisting of a motor with sprocket chain drive and reduction gears, operating a screw conveyor. One of the 4 by 4's failed, the scaffolding gave way and one of the two men standing on the platform fell into the machinery, crushing his neck and chest, causing immediate death. The other man was but slightly injured.



Comparison of January accidents

On inspection it was found that the piece of wood which snapped was a fir strip which had been used for form lumber, was unsound, and had a knot and two drilled holes close together. The lessons to be learned from this lamentable accident are (1) to invariably inspect and test all pieces of wood, other rigid members and chain supports to be used for scaffolding purposes, and (2) to effectually cover all moving parts before men are allowed to work above them.

Revokes Contract for Lime

THE Columbus, Ohio, board of purchase has whitewashed the waterworks lime contract dispute by throwing out both the bids submitted a month ago and deciding to advertise for new ones.

Subject of a city council investigation and a suit in court, the bids were rejected over protest of one of the three men on the board.

It is expected that it will be March 15 or 20 before another contract can be awarded.—*Columbus (Ohio) State Journal*.

Raids on Highway Funds Endanger Rock Products Industries

Attempts to Divert Gasoline Tax Receipts Threaten Jobs of Thousands of Road, Mill, Quarry, Coal and Transportation Workers

GASOLINE TAX RECEIPTS, the mainstay of modern road building which during 1931 amounted to \$524,000,000, are now dangerously exposed to the covetous eye of politicians. Under the pretext of worthy objects these funds are already being invaded, pledges made to the motorist taxpayers that gasoline levies would be used only for highway construction are being outrageously repudiated, and the highway industries with their thousands of dependent workers are being deprived of their rightful opportunity to sustain themselves and contribute to the economic welfare of the community.

Many politicians look upon the gasoline tax today as the fatted calf ready for the feast of the prodigals. In some localities the feasting has begun. Unless it is interrupted promptly the results will be not only serious misfortune for the industries which have been developed to serve our highway needs but a public calamity as well.

More Than a Million Jobs at Stake

A million workers found employment in our highway and street building industries in 1931 and 2,000,000 more were required to supply needed materials and equipment. Engineering and construction forces on the roads, workers in cement mills, sand, gravel and stone plants, brick yards, asphalt works and the steel industries will be jobless by the tens of thousands unless road funds are preserved for road building. Likewise, added thousands who labor on the transportation lines, in the production of power and in the coal mines will be transferred from jobs to charity. Contractors equipment lines must also suffer heavily. Obviously, the effects will be passed along to merchants and the community generally in the shape of further tremendous shrinkage in buying power.

To divert or "misappropriate" gas tax money is to retain the tax without the benefits, to cause more want than the funds involved could alleviate and to fly in the face of every sound economic argument. It would be difficult to find a device which, with equal inefficiency, transforms willing workers into victims of charity while robbing the public of the benefits of labor and materials purchasable now at lower prices than have prevailed in 15 or 20 years.

Why Gas Tax Diversion Must Be Fought

For the following sound seasons Rock PRODUCTS opposes diversion of gasoline tax

EVEN during the quiet of 1931, the automobile kept 4,000,000 directly at work and an additional 1,000,000 men busy supplying raw materials. Highway and street building employed 1,000,000 workers directly and the labor of 2,000,000 others was required in supplying equipment and materials. But if during the last few years highway construction had lagged, no one knows how much more serious economic conditions would be at present.

Frederick E. Everett, President, American Association of State Highway Officials.

money to any use other than the improvement of highways:

The gasoline tax for road building purposes is equitable because it is assessed against those who use the roads, the tax being in proportion to such use. For any other purpose the gasoline tax is inequitable because it places a second tax for such purposes on the vehicle owner, who already pays general taxes.

Owners of 26,000,000 motor vehicles paid almost \$1,000,000,000 in special motor taxes in 1931, according to the National Automobile Chamber of Commerce. In addition, they paid large sums in personal property and other general taxes.

According to the same reliable source an automobile owner pays taxes amounting to 18% annually on the average value of the vehicle during its lifetime, as compared with annual real estate taxes on urban land of 2.4% and farm land of 1.6%. The expense of road building and maintenance is borne by motor taxes and not by general taxes.

Examples of Tax Diversion

As indicating the extent to which gasoline tax diversion may be foisted upon the motorists, the New York state chapter of the Associated General Contractors of America, in a recent communication to Governor Roosevelt and the state legislature, said:

"In contrast with this drastic and far-reaching reduction in funds for needed public works, the gas tax has been increased 1c, which is estimated to produce \$15,000,000, and it is proposed to raise an additional \$11,000,000 from an increase in fees on motor buses and trucks, a total of \$26,000,000,

none of which is to be devoted to highways or the public works program."

H. H. Rice, writing on the subject in *Manufacturers Record*, said: "Motorists are not unmindful that road improvements add greatly to land valuation and that everyone, whether a car owner or not, shares in the benefit of better highways. Yet time after time this argument has been waived and car users have voted special taxes upon themselves. In so far as can be determined from the expression of motor club leaders this viewpoint prevails today, carrying with it but two provisos—the first, that these levies are special benefit taxes and consequently must be used for road building; the second, that they must be reasonable in amount."

Diversion of the gasoline tax for purposes other than roads is contrary to good public policy; it encourages the diversion habit with lawmakers.

The *San Francisco Chronicle* pointed out this danger clearly when it said in an editorial carried in its issue of August 27, 1931: "The slightest diversion of it (gasoline tax money) to any other state purpose will be the signal for a general scramble for the gas tax trough. The moment the gasoline tax is saddled with any other revenue need—no matter how commendable the object—the way will be opened to draw any or all other state taxes from the motorist's gas tank. . . . the precedent will have been set, the sound policy of the past will have been broken, and any or every tax use may demand a seat on the gas wagon."

The *Los Angeles Herald and Examiner* said recently: "Permit this grab, and the door will be opened wide for other diversions in the future, not only by the state, but also by county and municipal governments which may find themselves faced with the necessity of retrenchment or the discovery of new sources of income."

Recent Important Diversions of the Gasoline Tax

FLORIDA: Net receipts from 6-cent tax, \$13,655,175. Of this, \$3,803,629 was diverted for schools and school buildings, and \$19,680 for reserve fund.

GEORGIA: Net receipts from 6-cent tax, \$13,435,062. Of this, \$2,238,477 was diverted for public schools.

LOUISIANA: Net receipts from 4-cent tax, \$7,546,448. Of this, \$155,178 was di-

verted to purposes of the state dock board.

MARYLAND: Net receipts from 4-cent tax, \$6,991,188. Of this, \$1,314,438 was expended on city streets and grade crossings, and \$75,000 was diverted to the State Conservation Department for oyster propagation.

MISSISSIPPI: Net receipts from 5-cent tax, \$6,917,575. Of this, \$207,440 (largely from an extra 2-cent tax in Harrison county and an extra 3-cent tax in Hancock county, both for sea wall construction) was expended for sea wall financing.

NEW JERSEY: Net receipts from 2-cent tax, \$11,380,231. Of this, \$90,000 was spent for the free Bridge Commission and the Department of Navigation and Commerce, and \$3000 for the Public Utilities Commission.

NEW YORK: Net receipts from 2-cent tax, \$28,476,290. Of this, \$1,421,314 was paid to New York City and \$50,000 was held in reserve for refunds.

TEXAS: Net total receipts from 4-cent tax, \$29,527,098. Of this, \$7,381,774 was diverted to the free school fund.

There have been additional smaller diversions for miscellaneous purposes. Diversions of gasoline tax funds from highway construction for street improvement, amounting to \$11,842,930, were not listed above, as this use, while technically a diversion, probably falls within the purpose of the tax as understood by most motorists.

Summary—Gas Tax Diversions

During 1930, the states and the District of Columbia collected a net total (after refunds) from gasoline taxes of \$494,683,410. This fund was expended as follows:

For construction and maintenance of state highways.....	\$338,977,791
For construction and maintenance of local highways.....	96,225,637
For state and county road bond payments.....	31,049,036
For miscellaneous purposes (all diversions)*.....	27,328,759
Collection cost (when taken from gas tax revenue).....	1,102,187
	<hr/> \$494,683,410

*This item divided as follows:

For city street work.....	\$11,842,930
For city bridges.....	90,000
For public schools.....	13,404,200
For all other diversions.....	1,991,629
	<hr/> \$27,328,759

Such diversions break faith with the motorist. The popularity of the gasoline tax is entirely dependent upon the use of the proceeds to provide good roads.

Some Contemporary Opinions

"This," says a Louisiana contemporary (referring to diversion of the gasoline tax for purposes other than highways) "is a perfect example of the lengths to which officials have sought to go in socking the motorist's pocketbook."—*Alexandria (La.) Town Talk*.

"The diversion of motor-vehicle taxes to other than road purposes is not only unjust to the motorist taxpayers, but when added

to evasion and racketeering is demoralizing and threatens the breakdown of this entire tax structure," said Thomas P. Henry, American Automobile Association at hearing of Ways and Means Committee, House of Representatives, January 23, 1932.

The legality of using state gasoline tax money for purposes other than the construction of roads is questionable, inviting court attacks with probable interruption to collection and tying up of funds already collected.

The Quincy (Ill.) *Herald-Whig* for January 14, 1932, says with respect to the Barbour bill passed by the Illinois senate to divert a portion of the state gasoline tax allotted to the counties for the building of highways:

"It was only after there was assurance from the governor and those in control of the general assembly that this money could be used for road purposes only, that the (gasoline tax) law was passed. So far as the counties' share is concerned, the law makes it plain that this money can be used only in retiring bonds issued for the construction of state aid roads, or for the construction of such roads. The law passed by the senate would nullify the provisions of the gasoline tax statute, in the opinion of Quincy lawyers."

The Illinois Petroleum Marketers, in a display advertisement carried in Chicago daily newspapers on January 27, 1932, said: "The proposal that the (present) crisis be met by adding a cent or two to the tax on gasoline is unfair to those familiar with the gasoline tax situation. Necessity may com-

pel some oil companies to refuse to collect a higher tax if it is voted and to resort to the courts for justification of their stand against unfair discrimination. If some follow this course, all will have to do so in defense of their business."

Diversion of gasoline tax funds takes needed highway revenue. Attempts to restore this by increasing the tax are impractical because the point of diminishing returns has been reached.

Col. Sidney D. Waldon of the American Automobile Association testified as follows before the Committee on Ways and Means of the House on January 25, 1932: "The motor levy today is the heaviest on any non-luxury form of property in the United States. It is twelve times as heavy as the tax on rural real estate. It is almost eight times as heavy as the tax on urban real estate. At the rate of the 1931 tax the average car during its average life period

of seven years pays taxes in the amount of 139% of its average value.

"As an indication of how an increase in taxation affects the use of motor vehicles in Alabama, permit me to quote from a letter received from Leroy F. Hill, secretary of the Alabama Motorist Association, Birmingham, where there is a one cent city gas tax in addition to the state tax of 5 cents, as follows: 'You no doubt received my telegram estimating 60,000 registrations less in Alabama than on this date last year, and 75,000 less than for the preceding year.'

"At the present moment no less than 12 different forms of taxes on passenger cars have secured a foothold—State registration fees, state gasoline taxes, state personal property taxes, state driver's license fees, state registration card fees, state certificate of title fees, county gasoline taxes, county personal property taxes, city gasoline taxes, city personal property taxes, city wheel taxes, city driver's license fees, and city registration fees. It is understood that the 12 taxes cited are not levied in any one place.

"The experience of Pennsylvania is particularly noteworthy. On July 21, 1929, the 3-cent tax was increased to 4 cents. Nine months later, or in May, 1930, Pennsylvania collected \$2,681,448 under the 4-cent tax. On July 1, 1930, the tax was decreased from 4 cents to 3 cents, and 10 months later, or in May, 1931, collections under the 3-cent tax soared to \$3,880,815. Thus with a tax 1 cent less, collections were \$1,200,000 or 46% greater. In May, 1930, gasoline taxes in Pennsylvania were reported on 67,000,000 gal. while in May, 1931 under the lower rate, taxes were reported on 126,556,849 gal. Quite clearly lower taxes increase motor-vehicle use."

Modern highway requirements demand a fixed income for roads. Diversions from road money throw any system into confusion, causing waste and delay.

Must Stabilize Road Programs

Stabilization of highway programs and income are absolutely essential to the orderly progress of highway transportation. The American Road Builders Association has made this point clear through frequent utterances and has backed it up with its continued efforts for non-diversion of gasoline tax funds.

It is certainly good business to continue road improvement at a steady pace during 1932, while the road dollar will buy more construction value than ever before and probably more than it will buy for many years to come.

Road building has not only aided the industries directly engaged in construction, materials and machinery but it has increased the value of motor vehicles, sustaining the automobile and truck industry.

Frederick E. Everett recently said in commenting on the necessity of continuing

road building on its present scale: "We need good roads because we have some 26,000,000 passenger cars, trucks and buses, vehicles which during the lean year of 1931 were given a greater usage than ever before. Every dollar taken away from road building reduced the utility of the automobile and therefore its value. Every dollar spent in road betterment makes the car worth more. Neither the highway nor the automobile can be evaluated alone; both must be weighed together and considered as a single transportation medium.

"The automobile industry is the largest industry, employing in one way or another one-tenth of the nation's workmen. It is large because it serves a public demand and because the United States is building roads."

The gasoline tax relieves real estate of its tax load. Divert the gasoline tax and road expense must revert back to general taxes.

Motor vehicle taxes amounted to \$1,022,000,000 in 1931, divided as follows: Gasoline tax, \$524,000,000; license fees, \$348,000,000; personal property and municipal taxes, \$150,000,000, according to testimony submitted by the National Automobile Chamber of Commerce before the hearings of the Committee on Ways and Means of the House on January 23, 1932.

Motor vehicles paid nearly 10% of all federal, state and local taxes, according to the National Industrial Conference Board. Motor taxes amounted to \$1,022,000,000 as contrasted with total federal, state and local taxes, amounting to \$10,251,000,000.

Were real estate taxes called upon to replace gasoline tax funds the consequent increase in the former would have amounted to over 5%.

Diversion of gasoline tax money causes unemployment. Since an exceptional proportion of road construction costs goes into labor, the diversion of the money to other purposes invariably cuts down employment.

The following tabulation showing what a large proportion of highway expenditures goes to labor was contained in a statement by Thomas H. MacDonald, chief of the United States Bureau of Public Roads, before the subcommittee of the Committee on Appropriations, U. S. Senate, in January, 1932:

DISTRIBUTION OF \$1,000 PAID FOR CONCRETE HIGHWAY, SHOWING THE APPROXIMATE TOTAL AMOUNT WHICH REACHES LABOR IN EACH OF THE EIGHT SUCCESSIVE STEPS

The contractor's distribution of this \$1,000:	
Labor	\$ 141.00
Aggregates	324.00
Cement	324.00
Steel	27.00
Equipment	100.00
Plant installation	27.00
Bonding, etc.	22.00
Gross profit	35.00
	\$1,000.00

After distribution of mill and quarry items:	
Salaries and wages.....	\$ 302.70
Freight	406.70
Materials and supplies.....	17.50
Fuel	35.50
Interest	14.10
Taxes	24.10
Depreciation and repairs.....	131.15
Depletion	10.50
Profits	48.10
Miscellaneous	10.00
	\$1,000.00

After distribution of freight charges:	
Salaries and wages.....	\$ 477.70
Materials and supplies.....	57.55
Fuel	57.20
Interest	61.70
Taxes	49.70
Depreciation and repairs.....	184.65
Profit	91.00
Depletion	10.50
Redistribution	10.00
	\$1,000.00

After distribution of fuel costs:	
Salaries and wages.....	\$ 516.60
Materials and supplies.....	64.20
Interest and rents.....	63.75
Taxes	51.40
Repairs and depreciation.....	188.75
Profit	191.00
Depletion	14.90
Redistribution	10.00
	\$1,000.00

After distribution of repairs and depreciation:	
Salaries and wages.....	\$ 572.60
Materials and supplies.....	170.80
Interest, rents, etc.....	65.65
Taxes	56.10
Depletion	14.90
Profit	109.85
Redistribution	10.00
	\$1,000.00

After distribution of cost of materials and supplies:	
Salaries and wages.....	\$ 730.25
Interest and rents.....	73.85
Taxes	39.50
Depletion	17.85
Profit	128.55
Redistribution	10.00
	\$1,000.00

After distribution of taxes and \$10 for "redistribution" has been redistributed:	
Salaries and wages.....	\$ 770.85
Interest and rents.....	81.25
Profits	129.85
Reserve for depletion.....	18.05
	\$1,000.00

After distribution of profits, interest, rents, and depletion:	
Salaries and wages.....	\$ 910.00
Expended by owners.....	90.00
	\$1,000.00

This statement indicates that out of \$1,000 invested in concrete highway the contractor pays job labor \$141.00; quarry and mill costs contribute a salary and labor item of \$161.70 which added to the road labor becomes \$302.70. Similarly, the freight item adds \$175.00 to labor, the fuel labor item \$38.90, repairs and depreciation includes \$56.00 for labor, the material and supply account includes labor items totaling \$157.65. Tax and sundry accounts add \$40.60 for salaries and wages. The salary and wage items included under interest, rents, profits, reserves, etc., total \$139.15 making a grand total of \$910 or 91% of the original \$1,000 spent for wages and salaries.

Before hearing of Senate Committee on Post Offices and Post Roads, January, 1932, Senator Carl Hayden (Arizona) said: "I inquired of Mr. MacDonald (chief of the U. S. Bureau of Public Roads) and the

other officials as to how many men were employed, and their answers show that the difference between the number who worked on the roads last year and those who will be employed this year is between fifty and sixty thousand. In other words, between fifty and sixty thousand men who had work by reason of Federal road appropriations will be thrown into the body of the unemployed, and no work will be provided for them. It appeared to me that the only way to meet that situation was to offer an amendment to this bill providing for a second emergency road appropriation, and that is the purpose of my amendment."

"New York state employed in 1931 some 45,000 men directly and indirectly on highway construction and maintenance. The total expenditure of \$50,000,000 averaged \$1,333 per man, of which the man actually gets about 90% or \$1,200. One hundred dollars a month is little enough for a man to support a family on. There may not be the necessity to continue highway improvement continuously on the 1931 scale, but abrupt and unjustified curtailment will cause greatly increased unemployment, further depression in many lines of business and actual suffering." The above is quoted from a brief submitted in opposition to New York state tax diversion.

Diversion of gasoline tax receipts is decidedly unpopular and may destroy the benefits of the tax to road building as well as to the uses for which funds are diverted.

The Public Backs Us

Typical comment on this phase of the diversion danger, clearly indicates the trend of popular opinion:

"When other uses break into this revenue source the gas tax will no longer be paid cheerfully. Motorists will revolt and the upshot will most likely be the smashing of the state's highway program."

"When diversion has been made, strenuous objections arise from motorists and likely they eventually will force lower gasoline tax rates that would be disastrous for road building."

"The Automobile Merchants Association of New York is not opposed to a gasoline tax in principle, but we are very definitely opposed to spending the money collected from this revenue for any other purpose than the construction, reconstruction and maintenance of highways."

"The people of this state are satisfied with the gasoline tax, but they want it used on the highways, and the diversion of it to other purposes will not be tolerated."

"The proposal to increase the state gasoline tax and devote the extra funds thus raised to unemployment relief is creditable to the hearts of its makers but not to their heads. Never under any circumstances should gasoline tax money be used for any other purpose than highway building and maintenance."

"It behooves every citizen to take notice of the danger which threatens our state road system by the advocacy of this diversion proposal. It should, moreover, be the aim of every taxpayer to oppose to the utmost every confiscation of highway taxes for any other purpose whatsoever."

Diversion of gasoline tax money, by delaying highway construction and maintenance, increases the operating cost of motor vehicles.

The following table, taken from "Operating Cost Statistics of Automobiles," a bulletin by Professors T. R. Agg and H. S. Carter of Iowa State college, gives enlightening information on this subject:

TABLE 3—EFFECT OF ROAD CONDITION ON VARIOUS ITEMS OF OPERATING COST

Item of cost	Sum expended for the item when using high type roads	Sum required for equal mileage on intermediate type roads	Sum required for equal mileage on low type roads
Gasoline	\$1.00	\$1.20	\$1.47
Oil	1.00	1.00	1.00
Tires and tubes.	1.00	2.22	2.90
Maintenance	1.00	1.20	1.47
Depreciation	1.00	1.10	1.24
License	1.00	1.00	1.00
Garage	1.00	1.00	1.00
Interest	1.00	1.00	1.00
Insurance	1.00	1.00	1.00

Diversion of gasoline tax receipts to other purposes makes payments on outstanding highway bonds an obligation against general taxes with possibility of increasing the latter.

Gasoline tax revenue is pledged for the payment of interest and principal on outstanding highway bonds in the following states: Arkansas, Delaware, Iowa, Louisiana, Michigan, New Jersey, North Carolina, Oregon, South Carolina, and West Virginia.

If diversion of road funds is permitted, it is likely to be attempted in preference to seeking economies in governmental administration.

[Note—Reprints of this article for distribution by rock products producers will be made available in lots of 100, 500, 1000 or more at cost.—The Editor.]

Alley Paving Has Let-Down

THAT there is less interest in back yard neatness and sanitation is indicated by alley paving in 1931 when only 85 mi. of concrete alleys were built in the United States. This is a drop of about 85% from the peak year of 1927 when 550 mi. were laid.

Although no accurate figures are available, it is certain that there are thousands of miles of alleys in need of paving.

With construction prices now lower by one-fifth than they were two years ago, the paving of alleys constitutes an excellent medium for placing men at work. In offering suggestions to communities unearthing work for the jobless it should be sufficient to suggest these back yard thoroughfares.

Road Materials Tests Save State \$300,000

THE state of Wisconsin saved more than \$300,000 on 384 miles of concrete road built during 1931 through refinements in the making of concrete worked out by engineers in the highway materials laboratory at the University of Wisconsin.

This rather remarkable fact was disclosed in a report submitted to the Engineering Society of Wisconsin by a committee on materials of construction at the society's recent convention held at Madison. The actual saving to the state for the year was \$322,560, according to figures offered by Prof. M. O. Withey of the university department of mechanics.

The great saving in the cost of concrete pavement was explained as being the result of decreasing the amount of cement. The average amount of cement used per mile of 20-ft. pavement in 1931 was 560 bbl. less than that used in 1928. At \$1.50 a barrel this amounts to \$840 a mile for 384 miles of pavement. The decrease in the amount of cement did not decrease the quality of the concrete in any way. More careful proportioning of the materials that went into the concrete made it possible to secure economy without sacrificing quality.

Special cements designed to reach a high strength in from one to three days have, according to the report, been found to be economical in comparison with ordinary cements. Tests carried on in the materials laboratory of the university during the past three years have supplied some much-needed information on this point.

County Road Planning Developed

ADVANCE highway planning in several typical counties is now in progress by the National County Roads Planning Commission working in cooperation with the American Road Builders' Association according to Major Farny, chairman of the planning commission.

A manual of county planning has been prepared the purpose of which is to avoid waste in the counties and to provide for an orderly program of county highway work.

Special plans have been prepared for Morris county, N. J., and Prince William county, Va. These plans provide a comprehensive scheme for the future improvement of county roads and for their financing.

Improve Playground with Crushed Stone

PART of the playground at the Sunbury, Ohio, public school has been covered with crushed stone furnished by the Parent-Teachers' Association. Sixteen tons of stone were placed on the grounds.—*Sunbury (Ohio) News*.

Pennsylvania Crushed Rock Plant to Double Capacity

NAREHOOD BROTHERS, owners of a stone-crushing plant, are taking advantage of the winter lull in state and township highway building to double the capacity of their plant, which is situated near Limestoneville, Penn.

Early last spring they purchased a tract of land from H. M. Billmeyer, built a plant and installed a 35-ton gyratory crusher, with a capacity of about 800 tons of crushed stone per day.

At the peak of operations last summer and fall, as high as 33 motor trucks were engaged in hauling their product within a 30-mile radius of the plant.

Now these men are engaged in erecting an addition to the plant which will double its present size, and will install a 70-ton crusher capable of turning out 1500 tons of crushed stone per day.

The enlarged plant will be operated by electricity.—*Milton (Penn.) Standard*.

Investigates Dimension Limestone Price Control

INFORMATION which may lead to an investigation of alleged limestone price control was being gathered in Bloomington, Ind., December 5, by H. J. D. Hunt, of the United States department of justice.

Mr. Hunt was said to be making a study of competition faced by (dimension) limestone companies and of methods by which prices are determined.

Mr. Hunt was informed, it was reported, that limestone operators are virtually at the mercy of contractors, who determine their bids on quotations of sub-contractors. After the general contract is let, the first quotations are disregarded and contractors accept new bids for material, Mr. Hunt was told.

It also was believed that Mr. Hunt would investigate the reason for the drop in limestone prices, whereas sandstone prices virtually are unchanged. Mr. Hunt may attempt to learn if sandstone operators are organized to maintain a high price level, it was said.—*Peru (Ind.) Tribune*.

Norman S. Wear

NORMAN S. WEAR, 63, veteran sand dealer of Topeka, Kan., died February 21 at his home after a three weeks' illness.

Mr. Wear had lived in Topeka most of his life. He was one of the first automobile dealers in Kansas and had one of the largest agencies in the state.

Disposing of his motor car agency, Mr. Wear formed the Wear Sand Co. He was president of the company from the time of its organization until it was merged with other sand companies to form the Consumers' Sand Co. about eight years ago. He was a director of the latter company at the time of his death.—*Topeka (Kan.) Journal*.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Some Requirements of a Purchase Specification for Ready Mixed Concrete*

By R. B. Young

Consulting Engineer, Toronto, Ontario

THE STATUS OF CONCRETE has materially changed in the last few years. It is no longer exclusively a job-made product, but has become also a factory-made product, produced by an organization independent of either the contractor or engineer. This situation has made necessary a new type of concrete specification, one which deals with concrete as a building material, ready to use when delivered to the job. Thus a demand has grown up for a standard specification under which concrete can be purchased as is steel or brick, and which has the same standing and authority with engineers and architects as do the standard specifications for these materials.

The natural approach to the problem of preparing a purchase specification for ready mixed concrete is to take one of the accepted present-day specifications for job-mixed concrete and modify it to apply to the newer product. Such a procedure is sound but every requirement written into the new specification should be examined critically to see whether it is applicable or necessary in the present case. Also, it should be remembered that the ideal specification fully protects the consumer without unnecessarily interfering with or hampering the producer, and every requirement should be examined also from this standpoint.

A concrete specification falls naturally into nine divisions, as follows: general clauses, materials, proportions, consistency, measurement, mixing, delivery, inspection, tests and acceptance.

Under the first division comes such general items as scope and limitation of the specifications, the definition of ready mixed concrete, and any other matters of similar nature. It should not, however, include items dealing with questions such as damages arising from failure to maintain deliveries, payments and terms, and other matters that form part of the usual contract between

buyers and sellers of merchandise or services.

Materials

The materials to be dealt with under this heading are cement, aggregate, water and admixtures. The first two can be disposed of briefly by references to the existing standard specifications of the American Society for Testing Materials, and water can be covered by requiring it to be fresh and free from deleterious impurities.

Admixtures are not so easily handled. Most engineering and architectural specifications permit the addition of admixtures only when specifically authorized. On the other hand, many operators of central mixing plants have found that under certain circumstances an admixture helps them to deliver a better concrete. To forbid entirely the use of admixtures would hamper these particular operators, but to allow their use indiscriminately would bring the specification for ready mixed concrete in conflict with the majority of present concrete specifications, which would seem to be unwise. The author's own view of this dilemma is that it would be best to specify that admixtures may be used with the permission or on the instructions of the buyer, leaving it to the operator who wishes to use them, to convince his customer that they are needful and beneficial.

Proportions

In the concrete industry, the term "proportions" has come to have two meanings, the first referring to quality, the second to the quantities of the different materials required to produce a unit volume. While, strictly speaking, the first usage is not correct, the relation between quality and the quantity of ingredients used is so intimate that it is convenient to discuss both under a single heading.

The quality of concrete is usually specified in one of several ways: by arbitrarily set proportions, by cement content, by water-cement ratio, by compressive strength at

some given age, or by a combination of these, to which should be added a reference to the consistency of the concrete when delivered.

When arbitrarily set proportions are used as a measure of quality, the problem is to determine the equivalent batch quantities, and to provide for this, the specification should include a clause stating exactly what is meant by a cubic foot of cement or aggregate. The common practice is to consider that a cubic foot of cement is equivalent to one sack weighing 94 lb. net, and that a cubic foot of aggregate is equal to its unit weight when tested dry, in accordance with the standard methods of the A. S. T. M.

When any of the other three methods of stating quality are used, it is left to the producer to design a mixture that, with the proper consistency, will either have the required cement content or water-cement ratio or produce concrete having the specified strength at the age set. At once there arises the question of how far the producer shall be allowed a free hand in determining the mixes that will meet the requirements. All producers do not have the necessary knowledge to allow them to design concrete mixtures, but this is almost equally true of engineers and architects. There is, besides, the temptation to design the cheapest mixture that will "get by." It would seem, therefore, that some safeguards should be set up.

When the quality of concrete is defined by its consistency and either its cement content or water-cement ratio, or both, the minimum amounts of cement and water which the producer is likely to use are established within fairly narrow limits. It is improbable that the producer will use more cement than the minimum unless it is necessary to do so to meet the consistency requirement or the combined water-cement ratio and consistency requirement. In this case the only safeguard required is to prevent the producer from using too little or too much fine aggregate. This can be

*A paper read at the annual convention of the National Ready Mixed Concrete Association, Pittsburgh, Penn., January 25-26, 1932.

prevented quite simply by a clause such as has been used in a number of specifications stating that the quantity of fine aggregates in any concrete mixture shall not be less than one-third or more than one-half the total aggregate used.

When concrete quality is specified in terms of compressive strength there are added complications. It is necessary to state just what is meant by a certain strength at a certain age, and on what basis the concrete must be designed to insure to the buyer that the specified strength will be met. There is also the question of determining what constitutes performance in meeting the requirements. This will be discussed later, under "acceptance."

The question of how the specified strength shall be defined is logically taken care of by referring to the standard methods of testing concrete that have been developed by the A. S. T. M. and stating that lb. concrete shall have a minimum compressive strength of lb. per sq. in. at age when made, cured and tested in accordance with the standard methods of the A. S. T. M., leaving it to the engineer or architect to determine the relation that should exist between these requirements and working stresses, durability, fire resistance, and the like.

There is data available by which a producer of ready mixed concrete can design a strength concrete with reasonable assurance of meeting the requirements, but the most exact way is for him to have tests conducted on his own materials and base his designs on these tests. It seems to the author that it is hardly reasonable for a producer to ask a buyer to have confidence in his ability to meet a strength specification if he has not found out for himself what his raw materials will do. On this basis, the author would be inclined to require that designs for strength-specified concrete be based on actual tests of the producers' materials or equivalent data obtained during operation.

Building codes usually require that when concrete is designed on the basis of water-cement ratio and strength, the actual strength used in determining the proportions must be 15% greater than the minimum required by the code. This requirement should be included in the specification for ready mixed concrete, not only because it is a wise provision, but because a very considerable volume of concrete is sold subject to building code requirements.

There are many ways of determining the actual proportions necessary in any given case, by voids, water-cement ratio, mortar voids, trial and error, and so forth, and it would be difficult to include all of these in a specification without making it too long and cumbersome. It is unfortunate that these methods have not been codified by the A. S. T. M. or the A. C. I., as such a document would not only be of considerable assistance to the average ready mixed concrete operator, but could

advantageously be referred to in a specification.

No matter by what method the proportions are obtained, the batch quantities will be determined first in terms of dry aggregates and the total amount of water required. The specifications should require that before these may be used in batching, they shall be corrected as necessary for the natural moisture contained by the aggregate.

Consistency

Workability is one of the basic properties required of a concrete mixture. It is also the one of most immediate concern to the user and the one over which there is as much argument as any between user and producer. In practice, workability is referred to as consistency, and is usually measured by the slump test. So far, no better field method has been devised for this purpose than the slump test, and while it admittedly has many and serious limitations, it is sufficiently reliable and definite for the class of concrete mixtures generally used in the ready-mix industry, to be made a part of a specification. It is the author's suggestion that in the specification for ready mixed concrete the average slump of each class of concrete should be definitely stated, that reference be made to the standard method of determining slump adopted by the A. S. T. M., and that a tolerance of say 1 in. above and below the average slump be allowed to take care of minor variations in the consistency of the concrete and the known inaccuracies of the test.

Measurement

The weighing of aggregates has become almost universal practice in ready mixed concrete plants and its proved advantages make it a desirable requirement in a ready mixed concrete specification.

While certain authorities feel that measurement of the cement by weighing is not so essential since the sack of cement is a definite unit, the author is of the opinion that weighing of the cement should also be required. Cement should always be weighed in a separate hopper from the aggregates.

Mixing water can be accurately measured either by weight or volume, and the proper provision here would be to insist that whatever the device, its readings be accurate within, say $\frac{1}{2}$ to 1%. For truck-mixer operations, the measurement of water in the water tank mounted on the mixer should, in the author's opinion, be forbidden—instead, the proper amount should be measured at the plant at the same time the cement and aggregates are batched and the measured water then run into the truck tank when the mixer is being loaded.

The producer of ready mixed concrete should, for his own protection, have his

plant equipped with accurate weighing devices and the specifications should so require. It may be argued that this is a detail with which the buyer is not concerned if he gets the required volume and quality of concrete, but since the best assurance the buyer has that both of these requirements are being met is by plant inspection of the batch quantities, he is justified in insisting on the accuracy of the weighing equipment. This feature can be taken care of by specifying that all weighing equipment meet the requirements for weighing devices for concrete aggregates of the American Road Builders' Association.

Mixing

Any specification for mixing must take into consideration the two different systems used by ready mixed concrete plants; namely, mixing at the plant, and mixing in transit.

The first system differs in its requirements from the standards found necessary for job-mixed concrete, only in that the central-mixing plant usually uses mixers of much greater capacity than are found in job plants. The same safeguards that experience has found desirable for job-mixing should be required for central plant mixing, and some sliding scale of mixing time, increasing as the capacity of the mixer increases, should be included to provide for the slower mixing action of large mixers. The author would suggest a minimum requirement of one minute for mixers of one cu. yd. capacity and less, increased by one-half minute for each additional cu. yd. or less of capacity.

The truck mixer is somewhat more difficult to provide for in a specification than a stationary mixer, because it is not so well standardized, and information on the performance of different types is meagre. The drum should be watertight when closed; it should have a total volume of at least twice its wet batch capacity; and it should be driven at the proper speed. The proper mixing time is harder to specify for it varies not only with capacity, but with different types of mixers, and the differences between them are so great that it would be difficult to set a mixing time that would be safe for all, and yet be fair to the more efficient. Some study will have to be given to this point before definite limits can be set.

Delivery

Here again the requirements are somewhat different for the central-mixing plant than for truck-mixer plants. The author has had little experience with the former and does not feel competent to suggest what clauses are necessary in the case of this type of operation, but general experience seems to indicate that low-slump concrete can be successfully transported in non-agitating bodies, but that

for slumps above 2 to 2½ in., agitating-type bodies are necessary.

A question that has troubled many engineers and architects when asked to permit the use of ready-mixed concrete is, "what length of time should be permitted between the mixing and placing of the concrete?" It would appear from tests made that the strength of concrete is not materially reduced even if it is not placed for as much as three hours after mixing, but the consistency of the wet mixture, as measured by the slump, is reduced greatly. The tentative specifications for ready mixed concrete of the American Concrete Institute suggests that the elapsed time between the addition of the cement to the aggregate and the placement of the concrete in the forms be not over one hour. This limits the time that may elapse between the charging and discharging of the delivery unit to about 40 minutes. The author is inclined to the view that the elapsed time could safely be increased to 1¼ of 1½ hr. As hauls which limit truck equipment to one trip every two hours are seldom profitable, there is little likelihood that the producer will use this additional time to increase the average haul. More likely it will save for him certain loads that are delayed in transit or held on the job, that are entirely suitable for use, but are now returned.

When concrete is delivered by truck mixers, the same question of elapsed time enters, but in a slightly different way. Some operators add the gaging water to the mixer just before mixing, in which case the only moisture in contact with the cement prior to this time is the moisture contained by the aggregates. Other operators put the gaging water into the drum with the rest of the batch and some combine these systems. Most engineers will argue that the limiting time specified for delivery of central-mixed concrete should apply here, and this view will probably prevail when specifications are written, but when the bulk of the water is not added until the batch is mixed, two or three hours can elapse between batching and mixing with little or no detriment to the quality of the concrete. Where the bulk of the water is added with the batch, the same restrictions for elapsed time that apply to central-mixed concrete, would apply to truck-mixed concrete.

A great deal of concrete is now placed during the winter months. Years of experience with job-mixed concrete have taught most engineers and architects to specify that the aggregates and water are to be heated during this period, and the temperature of the freshly mixed concrete held between some such limits as 50 and 120 deg. F. It seems to the author that for ready mixed concrete the only provision needed is that the concrete when delivered shall fall within a certain range

of temperature to be set by the buyer and he would suggest for consideration 60 to 80 deg. F. for temperatures down to 25 deg. F. and 75 to 95 deg. F. for all temperatures below this.

The maximum rate at which delivery is to be made should be a matter of agreement between the producer and his customer, and the best place for such a clause is in the contract proper rather than in a specification for quality. Some limiting time between successive batches is a restriction thought desirable by many.

Inspection

The buyer of concrete should have the same right as any other purchaser of material or equipment to freely enter the plant of the producer and examine and test the raw materials and the different processes that enter into its manufacture. The cost of this inspection should be borne by the buyer and not by the producer.

Certain specifications for ready mixed concrete require that the producer's plant shall be under the direct supervision of a competent engineer. Unquestionably, it would benefit the industry if every plant had an engineer familiar with concrete technology responsible for the quality of the product, but so would the foundry business if every foundry had a metallurgist in charge, or the clay product industry if every brick and tile plant had a ceramist in charge. It seems to the author that one is on questionable ground when one includes this requirement in a purchase specification. It is hardly enforceable as it leaves to the buyer the decision as to who is or is not a competent engineer, and if there is any doubt in the buyer's mind as to the ability of the producer to meet the specification, he should not buy from him.

Tests and Acceptance

These two subjects are so intimately related that they can best be discussed together.

The buyer purchases ready mixed concrete to be delivered to some designated location, and it is his right to demand that the concrete should meet the requirements of the specification when and where delivery is taken.

The producer is only responsible for the quality of the concrete up to the time of delivery for he has no control over the concrete after the buyer receives it, and the latter can entirely alter its properties by his treatment of the concrete subsequent to the time it leaves the producer's hands.

For these reasons, it would seem to be desirable and necessary to base all tests and acceptance on the condition of the concrete at the time and place of delivery. The concrete should be sampled and slump tests made then, and not of the

concrete in the forms. The supervising architect or engineer will probably require that his samples be taken from the forms and it is here that difficulty is apt to arise, for tests are not likely to be made at both points and in case of argument, the producer either has to accept the former's tests or prove that the concrete has been abused. In order to protect themselves in case of dispute, many producers have an independent inspection company sample and test their concrete at the point of delivery, and while the practice can hardly be made mandatory, the producer who does so is wise.

The buyer of ready mixed concrete has a right to insist that the product he receives shall meet the specification in all particulars, and if it does not, he need not take it. But who shall decide when the specification is met? Certainly not the seller, nor has the buyer any more right to insist that his decision shall govern. There should be some way of definitely determining performance independently of either parties to the contract.

The buyer, under the inspection provision of the specification, has the right to sample and test the ingredients going into the concrete, he has the right to inspect the various manufacturing processes, and in both cases, if they do not conform to the specification, he has demonstrable facts to deal with in case of an argument. When it comes to the question of the quality of the finished concrete, there is more room for differences of opinion. As stated previously, quality is usually given in terms of consistency, and either proportions, minimum cement content, water-cement ratio, compressive or flexural strength, or some combination of these. Consistency is measured by means of the slump test and presents no difficulty; the compressive or flexural strength can also be measured if one will await the time required to cure the test specimens, but after a concrete is mixed, about the only possible way the proportions or cement content can be determined is by some system of unscrambling the wet concrete. It is the author's belief that some such test will have to be included in the specification as one of the acceptance tests.

For determining the proportions from a sample of wet concrete a test which has possibilities has been developed by Professor Dunagan of the University of Iowa, and is now being studied by the American Society for Testing Materials. This test is so new that data is lacking with which to determine the proper tolerances that should be used with it, but a little experience will remedy this deficiency. The same test could be used to determine the cement content of a freshly mixed concrete, but here again tolerance would need to be established. When the concrete in question has set, another test is available which is also being standard-

ized by the same society, and for which also tolerances have to be determined.

The Dunagan test might be used as well for determining the water-cement ratio of a concrete mixture, for it is claimed to measure the water in a mix to 1/10 gal. per sack of cement, and to be reliable to 1/4 gal., which in terms of water-cement ratio work out to .015 and .038 respectively. For specification purposes, a test for water-cement ratio should determine it to an accuracy of $\pm .03$ which is equivalent to approximately ± 150 lb. per sq. in. at 28 days. If the Dunagan test is as accurate as claimed it practically meets these requirements.

In addition to this, it is necessary to give the producer some leeway in the water content of his concrete. Just what this should be, the author is not prepared to say, but would suggest for study that the average water-cement ratio of the concrete delivered should not be less than the minimum specified and that any one batch of concrete tested should not fall below this minimum by more than 5%.

A great many cubic yards of concrete are now sold on a so-called strength specification. Such a specification appeals to many buyers as a simple way of shifting to the producer the responsibility for determining the proper proportions required to give the compressive strengths wanted by the engineer or architect, and it appeals to the producer since it gives him a greater opportunity to profit by his knowledge of concrete and raw materials. The great drawback to this form of specification is the difficulty of determining whether or not the producer has actually delivered concrete of the specified strength, and most specifications are very hazy on this very important point. The measure of performance for this kind of specification is the test of a hardened specimen of the concrete delivered, and this test is usually made from a week to a month after the concrete was built into the structure. The question always arises, "what happens if these tests do not meet the specifications?" Of course, if the concrete actually does not meet the specification, the purchaser may require its replacement, but this is such a costly procedure for both producer and purchaser that if there was any general likelihood that such an event was probable, few men would enter into this type of contract. The fact is that with any well-run concrete plant it is a very remote eventuality, and the principal danger from this type of contract is that some accidental condition will affect the tests adversely and the quality of the concrete will be questioned. If this happens and the buyer or the buyer's engineers are unfriendly or uninformed and the producer is unfortunate in not having protected himself by independent tests of his product and a proper understanding with the buyer of

what he has contracted to do, he may have a very expensive and nerve-racking experience.

A purchase specification for ready mixed concrete should cover these eventualities by definitely stating:

- a. Where and when the concrete is to be sampled.
- b. How the test specimens are to be made, cured and tested.
- c. When the tests indicate that the specification is met.
- d. What procedure shall be followed in case the tests indicate the specification has not been met.

The first point has been covered earlier in this discussion, when it was required that samples should be taken at the time and place of delivery of the concrete.

The second is covered if all tests are required to be made in accordance with the standard methods of the A. S. T. M. with the added provision that all test specimens are to be laboratory cured under standard conditions after the first 48 hours, and that the provisions in no case apply to so-called job-cured specimens.

When do the tests indicate that the specification has been met? The obvious answer is "When all of the tests are above the specified minimum." This may be the obvious and logical answer, but it is likely to be uneconomical and unfair.

The science of testing concrete is far from being exact, and a group of identical specimens made by skilled men in a well-equipped laboratory seldom have a mean variation from their average of less than 5%, and often much more. Also, practically all of the errors in carrying out the provisions of the standard methods of making, curing and testing concrete give test results lower than the true values. For these reasons, a producer of ready mixed concrete who has to comply exactly with the foregoing interpretation would have to design his concrete by such a wide margin that there would be absolutely no chance of failure. A reasonable margin of safety should be allowed in designing concrete mixtures and the 15% required under Proportions is expected to do this, but even this does not always provide for the accidents of testing. Therefore, it seems to the author that a tolerance should be adopted something after this character:

"The average compressive or flexural strength at 28 days or other age specified shall not be less than the minimum required by the engineer or architect" and in order to provide for the accidental low test it should be added "that the requirements of the specification shall be considered to have been met if not more than 10% of the tests fall below 90% of the specified minimum." Study of test data may show that other percentages or requirements should be used, but the au-

thor's experience would indicate that the above could be easily met by a well-handled concreting operation—either ready-mix or job.

The last question is "what procedure shall be followed in the event that the tests indicate the specification has not been met?" This contingency is most apt to arise when there is some question as to the correctness of the tests or there is a discrepancy between the producer's and buyer's tests. The producer should have the right, if he wishes, of obtaining cores of the hardened concrete in place. The buyer may argue that the concrete is older than the test age mentioned in the specification and there may be some doubt in the producer's mind as to how thoroughly the concrete has been cured. The producer should be able to insist on proper curing before samples are taken and the specification should state the field strengths that will be considered equivalent to the specified strengths at different ages. Sampling of the concrete should be done according to the standards of the A. S. T. M., and the contract should state who pays for the tests.

If the tests fail to meet the specification and the structure is a building, the producer, if he so desires, should be allowed at his own expense to test the suspected section under the provisions of the building code, and if the structure meets these tests, the requirements for quality shall be considered to have been met. If the structure fails to meet the building code requirements due to the quality of the concrete, the producer should be required to make the structure good or pay damages to the amount suffered by the purchaser. The contract, rather than the specification, should provide for these eventualities.

The producer who accepts orders for concrete under any specification cannot escape the consequences if he fails to live up to his contract, but the producer who undertakes to deliver concrete to a specified strength assumes special risks. He should never forget that fact, and should be certain beyond any doubt that his organization has the requisite knowledge, skill and equipment to carry out its obligations. He also should take all reasonable means of protecting himself against the ignorance or inefficiency of the other parties to the contract. Having done both of these things, he may feel confident that the likelihood of failure is too remote to be a serious hazard to his business or reputation, but failure to observe these simple precautions may cause serious losses.

One other item that should be included under Acceptance is a statement of how the volume of a batch of wet concrete is to be determined. The simplest method is to consider it the sum of the absolute volume of its ingredients, and for the ma-

jority of concrete mixtures the volume calculated in this way should agree with the measured volume within 1%. For very lean concretes, for lean mortars and for concretes made of very porous aggregates such as cinders or haydite, the calculated volumes are not reliable, due either to the presence of a varying amount of air voids in the concrete or to the diffi-

culty of determining the proper specific gravity of the aggregates. For these conditions, the correct volume of any batch may be determined by calculating the weight per cubic foot of the concrete from the weight of test cylinders at the end of 24 hours. Volumes determined in this way will check within 1% with calculated volumes when the mixtures used

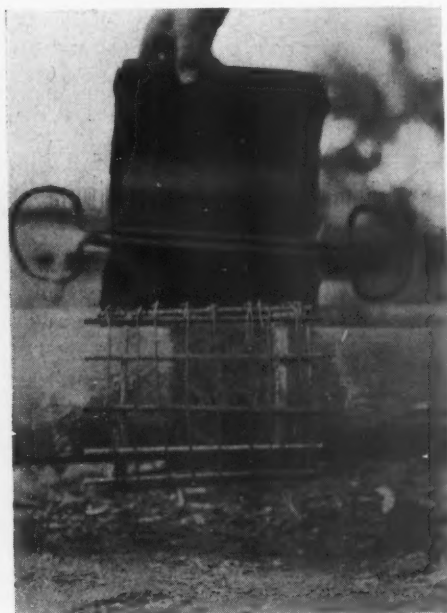
are free from air voids. It would probably be found satisfactory, if the specifications for ready mixed concrete allowed either method of determining volumes to be used, to have the added provision that, if the calculated volume differs more than 2% from the volume determined by weighing the test cylinders, the latter should govern.

Something New Under the Sun!

A New Method of Manufacturing Concrete Pipe Is Developed in Europe

By Ellis Clarke Soper
Consulting Engineer

WE AMERICANS are often prone to pride ourselves on being further advanced in modern industry, finance, the arts, etc., than our brothers across the sea.



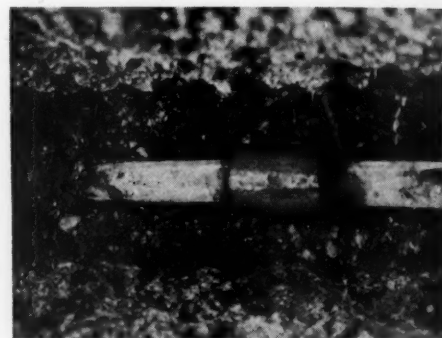
Joint ready for mold

The present world-wide depression, however, has been so bewildering to all, and particularly to the leaders of all branches of industry, that it is causing many of us to pause and consider. Our own perspective generally has been too narrow to admit of seeing what the other fellow was doing. Then one day, across the front page of the paper, we read that a *European* has traveled faster in the air or by train or boat than any human has ever done before. Or that there is a prominent continental country whose unemployed are numbered in five figures only, though its population is one-third our own.

Then we begin to wonder if we really are the world's leader in all things; and if we are, is the position an enviable one? And, incidentally, we are blamed for the present world's depression and the fall of sterling!

All of which brings us to the reason for this article.

Tucked away in a little village in Czechoslovakia, which, until the World War, was the "workshop" of Austria, is a plant producing reinforced concrete pipe. Of course there are reinforced concrete pipe factories nearly everywhere. However, when I was



Finished joint

told some details concerning this pipe I was most incredulous and decided to investigate.

After I had personally seen the pipe being manufactured, and later tested I wrote some of my friends in America, whose reactions to my statements were exactly like my own had been when I first learned about the pipe.

In a few words, this is what is happening:

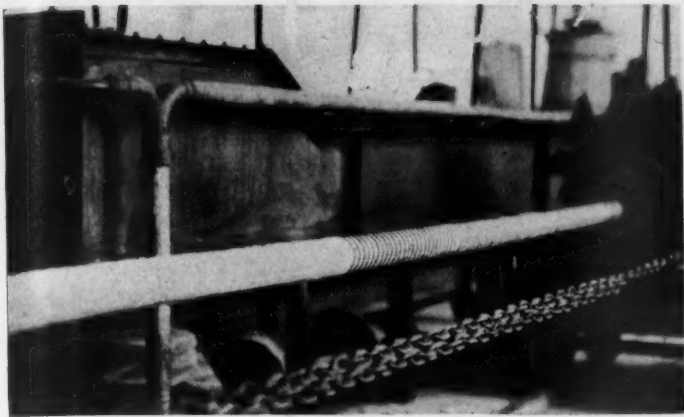
Concrete pipe (in which ordinary portland cement and sand are used) reinforced with ordinary steel is being manufactured in lengths of from 3 to 10 m. (10 to 33 ft.) and with diameters of $2\frac{1}{2}$ in. to 36 in. No



Reinforcing with spacers before placing the outer mold



Outer mold built to provide steam circulation without direct contact



Winding spiral reinforcing on concrete core

waterproofing material or other admixture is used.

These pipe are designed to withstand internal pressures of 75 lb., 150 lb., 225 lb. and 300 lb. per sq. in., though I have personally seen some of them successfully resisting internal pressures of 500 lb., 700 lb. and 900 lb. per sq. in.

The wall thicknesses vary from 1½ in. in the smaller sizes to about 3 in. in the larger sizes.

One most unique feature of this pipe is



Finished concrete core

that it is *flexible*! This statement appears incredible, but nevertheless it is true. One of the illustrations shows this feature remarkably well.

The method of making the joints for this pipe has been well worked out. A lead ring is cast a few inches from one end of each pipe; the two pipes are then placed end to

end and the surface of the pipe with the lead ring cleaned and slightly roughened for a few inches from the end.

Caulking yarn is wound round the pipe from the lead ring and just past the joint so as to prevent the concrete mixture for the joint entering between the pipe ends.

The reinforcing for the joint is now put in place, a metal-

hinged mold put around the reinforcing and filled with a mixture of cement fondu or alumina cement and sand.

Ordinary high early strength portland cement may be used.

These joints are most efficient and are completed with the pipe in position in less than five minutes.

Radical Departure From Regular Manufacturing Processes

The process of manufacture of the pipe is a radical departure from the methods in common use.

A metal core is used around which is placed the longitudinal reinforcing. This reinforcing is kept from the surface of the core and the mold in which it is next placed by means of short concrete cylinders (made in a simple machine from a paste of cement and asbestos) which are placed on the rods before they are wired together.

This mold is lined with steel and incased in wood and so constructed that steam may be applied to set the concrete mixture without coming in contact with it.

The mold is now filled with concrete under pressure, after which steam is immediately applied. During the steaming the metal core is slowly revolved and removed, leaving a polished inner surface of the pipe, whose frictional coefficient is negligible. After 15 to 30 min., depending upon the size of the pipe, the mold is removed and the pipe left



Stock of small sizes of finished pipe

in the storage pile to age one day. This pipe, or "core" as it is called, is hard and can be dropped to the ground immediately after removing from the mold without danger.

This "core" is next placed in a "winding" machine and slowly revolved. In this operation spiral reinforcing steel in a heated state is automatically wound around the "core." The spiral steel, when cooled, is thus in tension. This is one of the most important steps in the process of manufacture.

This spirally wound concrete core is next placed in a mold similar to the first one, and the process of filling under pressure and steaming is repeated. The finished pipe is aged for a day, tested and is then ready for shipment.

Possesses Many Valuable Properties

The uses to which this pipe can be applied are the same as those that metal pipe are employed for and in addition it possesses other very valuable properties. It does not rust nor scale, and, being basic or slightly alkaline, it is not affected by acids or alkaline liquids.

The pipe may be tapped and a connection made while the pipe is under pressure. This requires from three to five minutes for the small diameters.

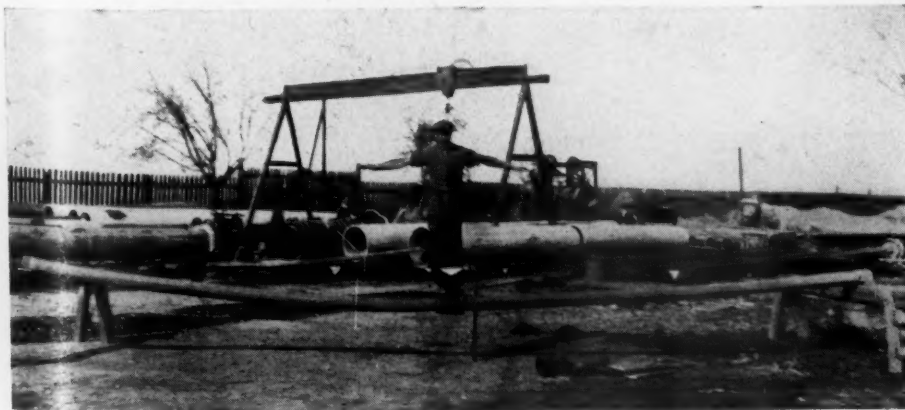
Competes With Metal Pipe

Its only competitor is metal pipe and its cost of manufacture is such that it can be sold considerably below the price of metal pipe and return a very substantial profit.

This process is the culmination of 20 years of work and intelligent experimentation by the Ruml brothers, the inventors. The history of their efforts to secure tension in the spiral reinforcing is particularly interesting.

Extensive and comprehensive patents have been applied for or are already granted in the principal countries of the world. The rights to use the patents and processes have been contracted for in several countries, including America.

When one considers the efforts constantly being made to save the various metal pipe lines of the country from rapid deterioration and that the annual protection and replacement value of the oil and gas lines alone is calculated at \$100,000,000, it would appear that there is a most extensive field for a pipe possessing the properties of this one.



Demonstrating flexibility—note deflection as indicated by white flags

A Standardized Gravel Plant

Eau Claire Sand and Gravel Company, Eau Claire, Wis., Has
Type Plant Designed to Solve Problem of Itinerant Competition

AT FIRST THOUGHT a standardized gravel plant may seem impractical to the experienced operator, but such a plant was installed by the Eau Claire Sand and Gravel Co. at Eau Claire, Wis., last spring and has been operated satisfactorily during the past season.

The J. C. Buckbee Co., engineers, Chicago, Ill., who designed the plant, have found that in 20 years of designing, building and operating gravel plants, approximately 75% of all the bank or pit gravel plants handled, and the majority of the plants investigated, had a capacity of about 1500 tons per 10-hour day, made four sizes of material, and handled bank-run material carrying 40% to 50% sand. This led to the conclusion that much money might be saved the sand and gravel industry by building a standardized 1500-ton capacity plant of steel construction throughout, which could be manufactured at minimum cost and quickly and easily erected by the owner's crew, using the stock piling crane and bolting the parts together. Then, if need be,

Editors' Note

THIS ARTICLE describes a type of plant that would seem to meet effectively one need of the sand and gravel and crushed stone industry.

It is standardized in so far that it may be fabricated at minimum cost and erected quickly and easily by bolting together. It could also be easily moved to another location, leaving behind only a few inexpensive concrete foundations.

It is stated that a complete plant such as this, including all equipment, can be delivered to any point in the United States or Canada at a price of about \$35,000.

The designer and promoter is an established and experienced producer of commercial sand and gravel, in a territory where portable plants have made serious inroads upon the established gravel producers.

To devise ways and means to combat this competition with a commercial plant was the objective sought after.—The Editors.

the plant could be taken down at any time in the same way, moved to a new location and re-erected, the only loss at the old location being a few concrete piers. Hence, such a design was worked out and standardized and the first installation made at Eau Claire.

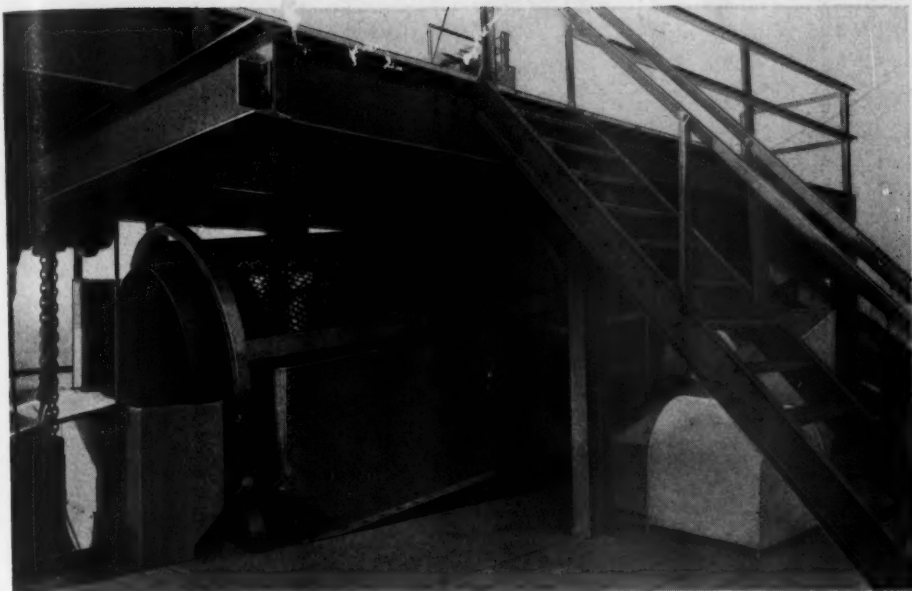
Eau Claire Plant

The gravel is taken from a deposit in the Chippewa river by a Monighan Diesel dragline excavator and hauled to the plant in 8-yd., Sanford-Day, drop-bottom cars by a 20-ton standard gage saddle-tank locomotive. At the plant the cars are automatically discharged into a small track hopper with bars across the top to exclude stones larger than 6 in. in size.

From this track hopper a 30-in. inclined belt conveyor leads to the top of the plant. The raw material is fed from the track hopper to the conveyor by a reciprocating feeder, driven from the foot shaft of the conveyor and having a simple means for adjusting the feed, so that the rate of feed to the conveyor may be in-



General view of standardized plant of Eau Claire Sand and Gravel Co., Eau Claire, Wis.



Scrubber and scalping screen, with discharge housings

creased or decreased while the feeder and conveyor are in motion.

The conveyor discharges at the head of the plant to a "stone shelf" that spreads the stream of sand and gravel and causes it to fall into a stream of about 900 gal. of water per minute, furnished by a motor driven centrifugal pump located at a sump about 300 ft. east of the plant.

The stream of sand, gravel and water flows from the conveyor head box into a 5-ft. diameter by 5-ft. long scrubber that is directly connected to a 5-ft. diameter by 9-ft. long open-end, steel-frame revolving scalping screen with $1\frac{3}{4}$ -in. round perforations. The scrubber is provided with three retarding rings and numerous lifting angles, so that the materials are well tumbled and rubbed in passage through the scrubber and if need be a high pressure water jet may be introduced through the open end of the screen to further wash the materials. One of the illustrations shows the construction of the scrubber and scalping screen and the discharge chute housings.

The oversize from the scalping screen flows to a 7-in. Newhouse suspended gyratory crusher placed immediately ahead of and slightly below the end of the screen. The lower part of this crusher and its oiling system are shown in one of the other illustrations. The product of the crusher, which is minus $1\frac{3}{4}$ -in. material, flows to a 16-in. inclined continuous bucket elevator about 35 ft. long, located at one side of the scalping screen. This elevator discharges into the feed chute of the scrubber just below the "stone shelf" on which the raw feed from the 30-in. conveyor falls and spreads.

The undersize from the scalping screen (minus $1\frac{3}{4}$ -in.) and the water used in the preliminary washing, flow to a 4-ft. by 8-ft. triple-deck vibrating screen set just

below and at right angles to the scalping screen. The top deck is equipped with $\frac{3}{4}$ -in. square mesh wire cloth, the intermediate deck with $\frac{3}{8}$ -in. mesh and the bottom deck with $\frac{1}{4}$ -in. mesh, so that three sizes of gravel are made: $1\frac{3}{4}$ by $\frac{3}{4}$ -in., $\frac{3}{4}$ by $\frac{3}{8}$ -in., and $\frac{3}{8}$ by $\frac{1}{4}$ -in. A high pressure spray pipe extends across the discharge end of the vibrating screen so that all materials are given a rinsing with clean water just before leaving the screen.

The discharge end of the vibrating screen is set directly over the intersection of the center walls of the storage bins below and, is provided with a steel housing divided into three parts. Each compartment has gates near the floor line, so that each size of material may be directed into any bin or mixed as desired. Thus, chutes for the finished material are re-

placed by this housing, simplifying the equipment and reducing expense.

The minus $\frac{1}{4}$ -in. material from the vibrating screen falls through a steel housing to a 20-in. double screw washer which dewateres the sand and, by means of a high pressure spray pipe across the upper end, rinses it with clean water just before it is discharged to the bin below.

The storage bins are of steel construction with self-cleaning hopper bottoms and are divided into four compartments. The cross partitions extend up at an angle of about 40 deg. so that the finished material may pile up at the center to the floor line, adding materially to the bin capacity and increasing the strength of the structure.

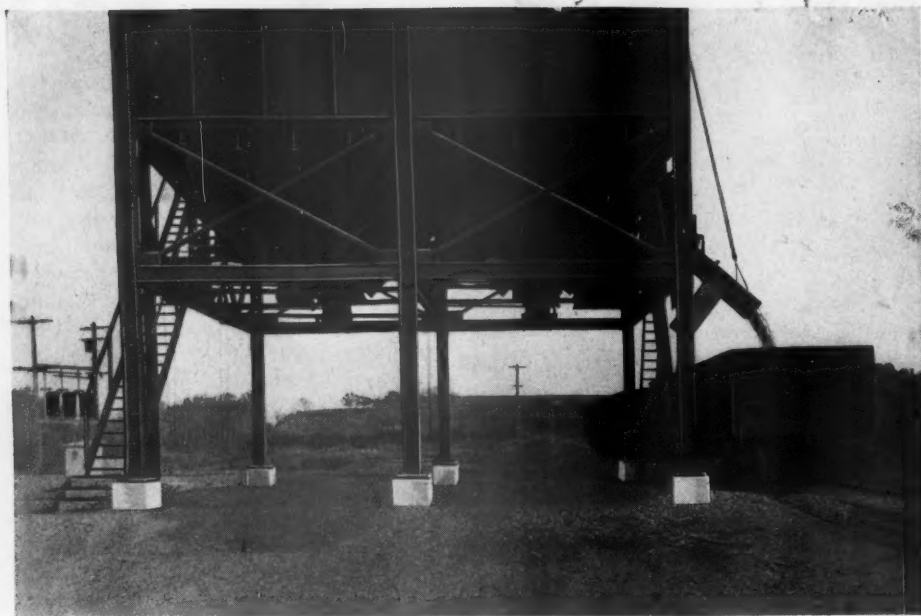
Each of the four bins has a live capacity of approximately 125 tons, giving a total live storage of 500 tons for the plant. Each bin has at the bottom of its hopper a 20-in. square undercut quadrant type gate, operated through a gear and shaft by a pendant chain at one side for truck loading.

In the center space between the hopper bottoms of the bins is a 30-in. belt conveyor about 32 ft. long which is driven by a 5-hp. motor at one end. Quadrant type gates in the side of each bin hopper and operated by ingeniously arranged hand levers at one end of the conveyor permit the operator to feed one or more sizes of material to it at one time. The conveyor is reversible so that by running it in one direction railroad cars are loaded on one side of the plant and by reversing it trucks may be loaded on the opposite side. The loading of either straight or mixed sizes is under complete control of the operator at all times.

The main inclined belt conveyor, scrubber and scalping screen, elevator and sand dewatering screws are driven by a 60-hp. motor located on the scalping screen



Reduction crusher and sizing screen below scalping screen



Lower part of bins and loading arrangements

floor and driving through a short Tex-rope drive to the countershaft of the scalping screen. From this shaft the power is distributed to the other units, all of which are driven from this shaft by SS-88 steel roller chain, so there is but one size and type of chain on the job.

The 7-in. Newhouse crusher has its own 60-hp. motor. The 4-ft. by 8-ft. vibrating screen is driven through a Tex-rope drive by a 7½-hp. totally enclosed, fan-cooled motor, mounted upon a bracket on the main frame of the screen.

A 5-in. centrifugal pump, direct-connected to a 50-hp. motor, furnishes 1000 gal. of water per min. against a 160-ft. head for washing. This is carried through an 8-in. pipe line to the head of the plant where branches lead to the scrubber feed chute, the vibrating screen and the sand dewatering machine. As the plant is but 60 ft. high there is considerable pressure at each outlet and valves are, of course, provided at each outlet to regulate the flow.

The whole plant with the exception of floors and walkways is of steel construction and all field joints are bolted. The design of the bins permitted the center columns to be omitted so that trucks have no intermediate columns to contend with. The floors are of 2-in. plank laid upon steel floor joists. The walkway at each side of the main 30-in. conveyor is of 2-in. plank carried upon 3x8 timber stringers and made in long, readily removable sections to suit the structural steel framework of the conveyor runway. The handrails are of steel in readily removable sections. The bin girders are the heaviest pieces of the structure but are of such weight and size that they may be readily put in place by any crane capable of handling a 1-yd. clamshell bucket.

The foundations consist of six concrete piers for the main plant columns and eight small piers for the conveyor bents and were stated to have cost only \$550.

The plant operating crew consists of two men, one of whom looks after the main conveyor head, scrubber and scalping screen, crusher and its elevator, vibrating screen and sand dewatering screws and watches the bins. The other man looks after the pump and reciprocating feeder and takes a hand in loading trucks and cars. Both keep an eye on the main belt conveyor, but as the idlers have roller bearings, the conveyor seldom needs attention during working hours. The vibrating screen and sand dematerialing screws are on the same floor so that the different sizes being made are all in view of the operator.

The plant has shown that it can easily produce 1500 tons of finished material per 10-hr. shift and when operating at this capacity required only 0.62 kw. hr. of power per ton of output. The maintenance cost of such a plant should be low and as it is "fire-safe," no insurance need be carried.

The J. C. Buckbee Co. states that this type of plant may be used for washing stone, in which case its capacity would be slightly less, and that it may be operated dry on either gravel or stone. In the case of dry operation, it is stated that the capacity would be slightly less, say 1000 to 1200 tons per 10 hours. When the plant is to be used to handle stone from a quarry, or gravel from a deposit carrying a high percentage of boulders, larger than 6-in. size, a primary crusher would be placed at the foot of the main conveyor to reduce everything to 5-in. size or less. It is also stated that a complete plant such as this, including all

equipment, can be delivered to any point in the United States or Canada for around \$5,000 and that patents are pending covering the plant arrangement and design. The development work and all detail drawings, patterns and templates have been made and standardized, so that all machinery and steel work can be put through the shop rapidly and at minimum cost.

State Gravels Road Berms at Mail Boxes

FUTURE paving contracts entered into by the Indiana state highway commission will contain a clause that contractors shall place gravel or stone on the road shoulder or berm in front of each rural mail box if set at proper distance from the pavement edge.

This action was taken by the commissioners following a controversy between a down-state postmaster and rural patrons who insisted upon setting their mail boxes up against the pavement edge because a rural carrier would not leave his vehicle to deliver mail when he found it impossible to drive over the soft shoulder.

William J. Titus, chief engineer, has been instructed to incorporate the clause into all future paving contracts.

In order to extend service and make state roads safer, highway commissioners took the position that the department should place the metal between mail box and pavement edge, so will include this work in the regular paving contract.

New paving contracts of the state department call for an 8-ft. berm, and an agreement has been reached between the United States Postoffice Department and the state highway commission that where shoulders are 6 ft. wide the mail box shall be 5 ft. from the pavement edge, and where the berm is 8 ft. or wider, the mail box shall be back 6 ft. from the pavement edge.—*Washington (Ind.) Herald*.

Farmer Sues for Damage from Blasting

SUIT against Jefferson county, Kentucky, for \$2330 was filed recently by Guy A. Mathis, farmer, who alleged that his farm adjoining county quarry No. 2, near Jeffersontown, has been damaged by blasting.

The petition declares that a rocky formation forming a pond on Mr. Mathis' property has been cracked, ruining the pond and making it impossible for Mr. Mathis' cattle to obtain water there. It added that the pond was formerly 6 ft. deep.

Damages were also asked because a 10-acre pasture is considered practically worthless for grazing purposes because of showers of rock whenever blasting occurs. Physical damage was listed at \$1250 and diminution of property value \$1080.—*Louisville (Ky.) Courier-Journal*.

Importation of Russian Asbestos

FOLLOWING recent reports that the United States Tariff Commission has virtually completed investigation of Russian asbestos fiber imports, with likelihood that no action will be recommended for violation of tariff provisions, it is learned that most of the mineral imported during the last year and held in storage awaiting outcome of the probe has been sold.

The asbestos market in the United States is said to be in the control of English capital through ownership of the principal source of supply located in Canada. The market for crude asbestos fiber from Canada ranges from \$100 to \$200 a ton, while the Russian equivalents have been from \$60 to \$120. The complaint of unfair trade practice was made on behalf of domestic processors, but it has placed this government in the unusual position of assisting Canadian producers in overcoming competition from another country, according to opinion in the trade.

Representatives of the Russian asbestos producers stated that very little has been imported while the complaint was pending before the Tariff Commission. They said, however, that practically all of the asbestos brought in prior to the filing of the complaint, and therefore not subject to bonding, had been disposed of through re-exporting and domestic sale.—*New York (N. Y.) Journal of Commerce.*

R. B. Dickinson Robbers' Victim

ROBERT B. DICKINSON, 51 years old, of Lake Forest, Ill., vice-president and general manager of the Marquette Cement Manufacturing Co., was kidnaped early the morning of March 5 by two men in front of the Swedish Club, 1258 North La Salle street, Chicago, robbed and thrown from their car in front of 1420 Elston avenue. He lost a \$1000 ring, a \$100 watch and \$25 in cash.

Mr. Dickinson was emerging from the club with E. P. Rich, 4751 Drexel boulevard, a consulting engineer, when the bandits seized them and forced them into a taxicab. Mr. Rich fought himself free and the robbers drove away with Mr. Dickinson.—*Chicago (Ill.) Tribune.*

Obtains Patent for New Cement

APATENT for a cement made of white sands and lava rock found in the vicinity of Las Vegas, N. M., has been issued to A. L. V. Nilsson of Tularosa.

The new cement is supposed to be equal in quality to portland cement and is adaptable to road work.

Plans for the manufacture and sale of the product have not been completed, Mr. Nilsson said.—*Las Vegas (N. M.) Option.*

Award Initial Cement Contract for Hoover Dam

DEFINITE AWARDING of the contract for cement for Hoover dam to the group of four companies which submitted a joint bid was announced recently by E. E. Duque, vice-president and general manager of the California Portland Cement Co. This contract calls for delivery of approximately 400,000 bbl. of material in one year to Hoover dam.

The companies united in the bid as reported in *Rock Products*, January 30, are the Riverside Cement Co., California Portland Cement Co., Monolith Portland Cement Co., and Southwestern Portland Cement Co.

An advantage gained by obtaining this award lies in the fact that it will have considerable bearing on the contract for material for the dam proper, it was claimed by Mr. Duque. Bids for that part of the project probably will be called during the early part of next year, the *San Bernardino (Calif.) Sun* reports.

Indiana Awards Cement Contracts

CONTRACTS for 1,800,000 bbl. of cement were awarded recently by the Indiana state highway commission, with Indiana companies receiving the preference in all except a few instances.

The Lehigh Portland Cement Co. received contract for 425,000 bbl.; Lone Star Cement Co. 500,000 bbl.; the Marquette Cement Manufacturing Co. 200,000 bbl.; Cosmos Portland Cement Co. 25,000 bbl.; Wabash Cement Co. 425,000 bbl., and the Louisville Cement Co. 425,000 bbl.

The price per barrel was stated to be around 98c.

Companies Not Included in New Aggregates Corporation

ANNOUNCEMENT that the General Aggregates Corp., Memphis, Tenn., has not completed its original plan to include the Central Sand and Gravel Co., Memphis, Tenn.; the Greenville Sand and Gravel Co., Greenville, Miss., and the Camden Gravel Co., Camden, Tenn., in its new organization is made by W. W. Fischer of the Fischer Lime and Cement Co. These companies are still separate corporations still controlled by the Fischer company.

Bars Sand Pits from City

NEW sand and gravel pits inside the Spokane, Wash., city limits are prohibited under an emergency ordinance passed by the city council February 29.

Action was taken when a delegation of property owners appeared with a petition of protest against a pit proposed to be opened by Jewel Frese.—*Spokane (Wash.) Chronicle.*

Lehigh Valley to Have a New Cement Plant

FRED B. FRANKS, who has constructed and completed four cement plants, advises the incorporation of the National Portland Cement Co., with general offices in the Finance building, Philadelphia, Penn., and projected mill at Brodhead, Northampton county, Pennsylvania.

He advises that construction work on the office building was to have commenced the first week in March, Arthur P. Houser, Emaus, Penn., being the contractor.

The plant will have an annual capacity of 1,250,000 bbl., and is to be located on 204 acres of land in lower Nazareth and Bethlehem townships.

The organization of the company consists of: President, Robert H. Anderson, Ambler, Penn.; vice-president and general manager, Fred B. Franks, Sr., Allentown, Penn., treasurer, Louis Rafetto, Philadelphia, Penn.; directors, Harold F. Ricker, Easton, Penn.; Albert H. Ott, Bethlehem, Penn.; L. Elwood Dize, Crisfield, Md.; Ira W. Richards, Easton, Penn.; Arthur P. Houser, Emaus; and J. M. Schoenly, Sr., Bethlehem. The chief engineer of the new company is Andrew P. Hachtmann, Allentown, Penn., who during 30 years of experience has been with the Atlas Portland Cement Co., Fuller Lehigh Co., and the Alsen Cement Co. For seven years he was located in London as consultant in Europe for the cement industry, and aided in the establishment of plants in Germany, France, Spain, Portugal, Italy, Switzerland, Belgium and Denmark.

It is announced the entire product of the mill will be high-early-strength portland cement, which will attain in 24 hours the strength ordinarily obtained with portland cement in seven days. It is stated that European as well as American machinery manufacturers are interested in the project. It is not stated in the announcement whether wet or dry process will be used.

At a dinner meeting of the directors and incorporators in Allentown, Mr. Franks is quoted by the local newspaper as stating that in his opinion that is the most opportune time ever for the location of a modern plant of the kind proposed by the National Portland Cement Co., with a product especially designed to meet the demand for high-early-strength cement. He estimated the cost of the new plant as \$2,700,000.

The company has been chartered in the state of Pennsylvania, its capital stock issue approved by the State Securities Bureau.

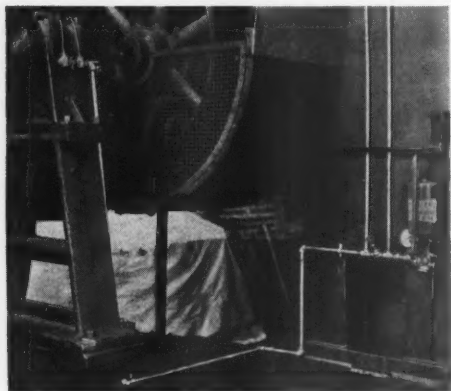
To Manufacture Incor Cement in Texas

THE LONE STAR CEMENT CO. plant near Dallas, Tex., is being remodeled to permit manufacture of Incor cement. It is stated that the company expects to manufacture 300,000 bbl. of the product this year.

New Machinery and Equipment

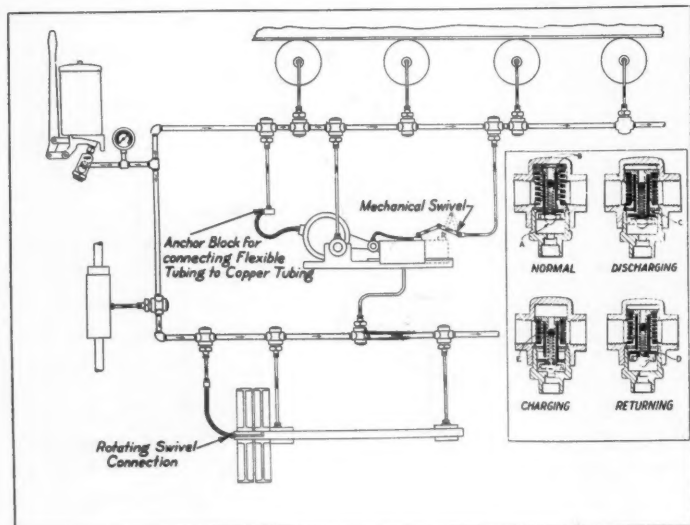
Mechanical Pressure Lubrication

THE Alemite "Metromatic" lubrication system, a multiple pipe line system that forces lubricant into bearings while machinery is running, is announced by the Alemite Corp., Chicago, Ill.



Typical installation

This system employs a pipe line arrangement whereby the lubricant may be forced under high pressure to each bearing on a machine. A measuring valve, located on the pipe line near the bearing, discharges a predetermined amount of lubricant at each operation of the pump handle. The operation of these measuring valves is the distinctive feature of this system. The manufacturer states that there is no possibility of lubricant by-passing into the line. The measuring valves on the pipe line are connected in multiples and as many branches as necessary can be taken off, at any point where other bearings need to be supplied, the manufacturer states.



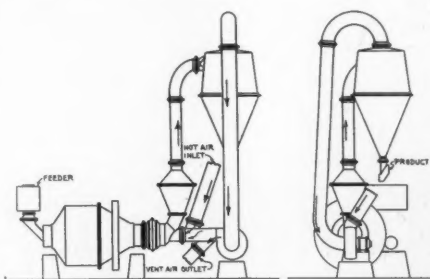
Detail of measuring valve and flexible connections

In operation, the compressor is pumped up to a pressure of 2000 lb. and the valve is released. This forces fresh lubricant into the bearings and charges the measuring valves for the next discharge operation.

Advantages claimed for this system of lubrication are personal safety to operators; all bearings are lubricated without stopping operation; bearing life is prolonged; eliminates waste of lubricant; quantity of lubricant is controlled; improves shop appearance; operating efficiency is increased; and lubrication of bearings while in motion affords better distribution.

Conical Mill Developments

FURTHER DEVELOPMENTS have been announced by the Hardinge Co., York, Penn., in the system of drying while pulverizing in its conical ball mill. The



Side and end views of conical ball mill

illustration shows the arrangement of the mill for air drying.

Included among the developments are the hot air inlet that is in the pipe used by the blower for forcing the oversize return from the air classifier back into the mill. The vent air outlet is ahead of the hot air inlet, and discharges the moisture laden air that has passed through the system.

The outlet is so arranged that the required amount of air is said to be withdrawn adjacent to the blower outlet. This, it is claimed, creates a partial vacuum in the mill which draws the hot air in directly at the point where the oversize is being returned

from the classifier. The oversize is thus heated as it passes through the current of hot air on its way back to the mill, where it mixes with the moisture laden incoming feed. This method of heating the oversize before it mixes with the damp feed is said to prevent any tendency to pack, as well as to accelerate drying within the mill itself. The manufacturer states that the hot air entering the mill absorbs and carries off the moisture liberated from the material. This "two way" action, it is claimed, increases the grinding efficiency of the system.

Cleanup-Rehandler Bucket

THE Wellman Engineering Co., Cleveland, Ohio, announces the addition of a new bucket to its line, the Williams "Champion" cleanup-rehandler.

Features claimed for this bucket are that



Three-part closing line handles cleanup

its scoops cover a big area, that extended corner brackets give extra digging leverage, it has a narrower and more rigid head, and its power arm combination gives faster re-handling by developing high digging power with minimum cable overhaul.

The manufacturer states that most classes of rehandling and cleanup work can be done with only three parts of closing line, but that it can quickly be changed over to 4-part reeving whenever needed.

Roller Chains

THE CHAIN BELT CO., Milwaukee, Wis., has issued a new book, Rex Roller Chains and Sprockets. The book contains information on the design and application of Rex roller chains, block chains, leaf chains and cut tooth sprockets.

Opens Office in United States

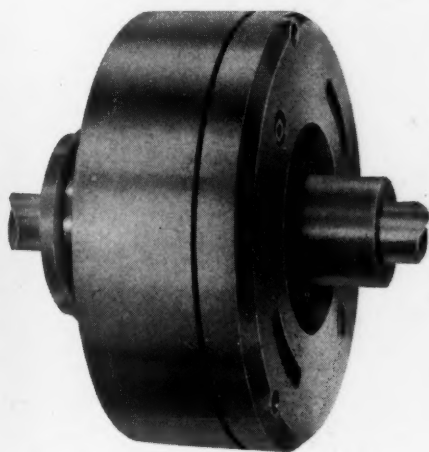
R. FUESS, INC., New York, N. Y., has opened offices in New York City to distribute a line of instruments for scientific research and industrial control. This is an American subsidiary of R. Fuess, Berlin-Steglitz, Germany.

The parent company was organized in 1865 for the calculation and construction of optical instruments. Rudolf Fuess, the founder, is said to have built the first crystallographical universal apparatus. The organization has developed various scientific instruments, among which are included instruments for the measurement of pressure, temperature and humidity of air; for measuring velocity, quantity and pressure of air and gases; for microscopy; for observation of water level, measuring quantities of water and for registering time; for testing powder and dust content; and for many miscellaneous uses.

Magnetic Friction Type Clutch

THE Dings Magnetic Separator Co., Milwaukee, Wis., announces a new magnetic friction type clutch of smaller physical dimensions.

This is a clutch having contact faces on



Its physical dimensions are smaller

both sides of a spring disc which are squeezed between the magnet and armature elements when the coil is energized. Theoretically the power transmission of this clutch is double that of a single friction contact face but actually it is of approximately 75% greater torque with the same magnet strength, the manufacturer states.

Provisions are made for adjustment to compensate for wear of contact faces. Light springs on the armature holding bolts serve to expel the armature when the coil is de-

energized to provide clearance between the two clutch elements.

Also the Dings company has developed a single spring disc clutch following the same general construction as the above described unit but having three friction contact faces which is claimed to have increased torque and power transmission.

A housing over the slip ring brush holder assembly is provided to protect it. The friction wearing faces are asbestos compounds formed to fit the clutch disc to which they are riveted.

According to the manufacturer, the coils are form wound, vacuum pressure impregnated and securely held in the magnet element from which they are amply insulated. It is without projections and all dowel pin holding bolts have locked nuts.

Forms Distribution Department

A DISTRIBUTION department has recently been added to the commercial department of the General Electric Co., Schenectady, N. Y., to take charge of the finished stock of all products exclusive of those of the incandescent lamp, electric refrigeration, merchandise, and plastics departments. This new division will be headed by J. V. Anthony, formerly connected with the San Francisco office, as manager, and Hancock Griffin, former supervisor of district stocks and warehouse, as assistant manager.

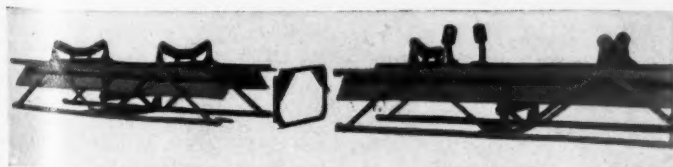
In addition to the handling, warehousing, shipping and billing of finished stocks, both at the various works and at the sales warehouses, the distribution department also has the function of studying methods and inaugurating changes in procedure for the purpose of providing the best possible service at minimum expense.

Adds Sectional Belt Conveyors to Line

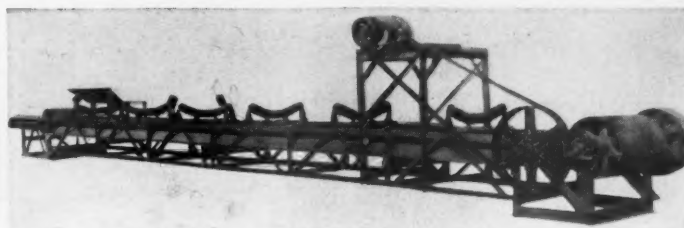
THE Fairfield Engineering Co., Marion, Ohio, has recently increased its line to include sectional belt conveyors.

These sectional conveyors are built of standardized units, making it possible to extend any conveyor to suit the requirements of plant expansion. Standard head and foot sections, of size to provide for ultimate conveyor length, together with the required intermediate sections for initial use, are originally provided. Additional intermediate sections can then be added as desired.

Steel frames are usually furnished.



Showing connection of sections



Drive at head end of conveyor

However, if the purchaser prefers to furnish timber frames, complete sets of parts may be purchased.

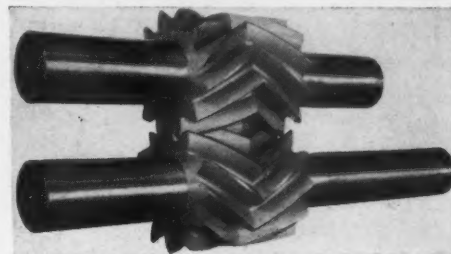
The steel frame sections as furnished by Fairfield are of the Warren truss type, welded throughout. The various units are joined together by means of heavy sleeve bolts. The returning belt is protected by a sloping steel cover.

Fairfield sectional belt conveyors are built with belts 18- or 24-in. in width. Maximum capacities under ideal conditions, for material weighing 100 lb. per cu. ft. for the two sizes, are as follows: 18-in. belts, 160 tons per hr.; 24-in. belts, 290 tons per hr. Fairfield ball bearing idlers are used throughout in these conveyor sections.

These conveyors are driven by either electric motor or gasoline engine, depending upon the requirements of the buyer.

Herringbone Pinions Used as Pump Rotors

THE accompanying illustration shows a pair of Farrel-Sykes herringbone gears which are being used as impellers, sometimes called cams and rotors, for the gear



Will operate as pump rotors at 1800 r.p.m.

type of pump. These pinions are manufactured by the Farrel-Birmingham Co., Ansonia, Conn.

The manufacturer states they have numerous advantages for this purpose. It is claimed that pumps made with these gears are more efficient mechanically and volumetrically; that they can run at a very high speed; and that the smaller size pumps are used with motors direct connected to them, running up to 1800 r.p.m. In some special cases it is said the gears are used for pressures up to 1500 lb. per sq. in.

The gears shown in the illustration run at 435 r.p.m. and pump 625 gal. per min. against a head of 200 lb.

Farrel-Sykes pump rotors are made in a variety of materials.

The Rock Products Market

Wholesale Prices of Aggregates

(F.O.B. Plant or City Designated)

	Crushed stone Screenings, ½ in. down to 2½ in.	Sand ¾ in. and less	Gravel, ½ in. and less to 2 in.	Slag Crushed, ½ in. and less to 3 in. and larger
Prices given are for crushed limestone per ton, unless otherwise stated				
EASTERN:				
Albany, N. Y.		.90*	1.35*	
Alexander, N. Y.		.65d	.65d	
Bethlehem, Penn.			.50-.60	.50-.90
Boston, Mass. (g)		1.15	1.75	
Buffalo, N. Y.	1.25†	1.25†	1.00-1.10d	1.50d 1.50-1.60d
Clarence, N. Y.		.60v	.60v	
Hartford, Conn.	1.40	1.40	.80	1.40
Hillsville, Penn.	.85	1.25		
Montoursville, Penn.		.60-1.00	.50-.60	
New York City		1.00	1.50	
Philadelphia, Penn. (trap rock)	2.16-3.51	2.36	1.55	2.05
Rochester, N. Y.		1.40	1.40	
Utica, N. Y.	.50-1.00	.75-1.35	.50-.75	.60-1.00
Washington, D. C.		.85	1.30	
CENTRAL:				
Alton, Ill.	1.75			
Chicago, Ill.		1.00	1.11	
Davenport, Iowa	1.00	1.25		
Dubuque, Ia.	1.00	1.00		
Eau Claire, Wis.		.35-.40	.80-.85	
Greenbush, Mich.		.30-.40	.55-.70	
Grand Rapids, Mich.		.30-.40	.60-.70	
Hannibal, Mo.	1.00	1.25		
Indianapolis, Ind.		.40-.50d	.50-.60d	
McCook, Ill.	.60	.60		
Milwaukee, Wis.	1.34	1.44	.96x	1.11x
Pacific, Mo.		.30	.50	
Stone City, Iowa	.75	1.00		
St. Louis and Maplewood, Mo.	1.25	1.25	.70	1.00-1.10
St. Paul, Minn.	.75	1.25	.35	1.25
Toledo, Ohio	1.16	1.66		1.10
Waukesha, Wis.	.90	.90	.40	.60
SOUTHERN:				
Birmingham and Woodward, Ala.				.55† .90-1.25†
Cartersville, Ga.		.90	.80	.80
Chico, Tex. (u)	.50	.90		
(Trap rock)	2.25u	1.10u		
Columbia, S. C. (granite)	.50	1.40		
Ensley, Ala.				.80 .80-2.05u
Ft. Spring, W. Va.	.35	1.35-1.40		
Fort Worth, Tex.		.75	1.00	
Houston, Tex.		1.25*	1.95k	
Knoxville, Tenn.		.70	1.00	
Longdale, Va.			.75	1.05-1.15
Montgomery, Ala.		.25-.35	.50-.60	
New Braunfels, Tex.	.50	.90		
Roseland, La.		.40	.75	
San Antonio, Tex.	1.50w	1.50w		
WESTERN:				
Crushton, Calif. (San Gabriel Valley)				
(granite)	1.40	1.40	.80	1.40
Denver, Colo. (h)			1.15*	1.75*
Long Beach, Calif.				
(Granite and trap rock)	2.40	2.40	1.50	2.40
Phoenix, Ariz. (n)			1.65	1.50
Roscoe, Calif. (San Fernando Valley)				
(granite)	1.40	1.40	.80	1.40
San Francisco, Calif. (Bay points)			1.45	1.45
Seattle, Wash.			1.25*	1.25*
Tulsa, Okla.	.70s	1.35s		1.25

*Prices per cu. yd. †F.o.b. cars. ‡Less 10c per ton monthly settlements disc. †Prices less 5c disc. per ton for payment 15th following month. (a) Consumer prices subject to cash disc. of 10c per ton. (b) ½ in. to 1½ in. (c) 1½ in. and less. (d) F.o.b. trucks at plant. (e) Delivered in truck loads. (f) ¾ in. to 2½ in. (g) Delivered to job by truck, Boston. (h) Pea gravel, per cu. yd., 1.15. (i) Less 10c cash disc. (m) 2 in. and less. (n) Per cu. yd. in city limits. (p) Hard-head stone. (q) ¾ in. to 2½ in. (r) Crushed slag, ½ in., 90c-1.00; ¾ in., 50c-60c; 1½ in., 60c-70c; 2½ in., 60c-80c. (s) Less 15c per ton for cash 10 days. (t) Delivered on job. (u) F.o.b. plant. (v) F.o.b. cars or trucks. (w) F.o.b. job, San Antonio. Also \$1.25 f.o.b. cars. (x) Also 1.00-1.40 per cu. yd.

Masonry Cement

Packed in paper sacks. Prices, f.o.b. cities named, include cost of sacks.

	Per bag	Per bbl.
Cincinnati, Ohio	.44	1.76
Cleveland, Ohio		†1.55
Columbus, Ohio		†1.71
Dayton, Ohio		†1.62
Detroit, Mich.	.47½	1.89
Indianapolis, Ind.	.43	1.72
Louisville, Ky.	.41	1.64
Memphis, Tenn.	.49½	1.97
St. Louis, Mo.	.46½	1.85
Toledo, Ohio		†1.59

†Subject to cash discount for payment within 15 days from date of invoice.

Mica

Prices given net, f.o.b. plant or shipping point.

Martinsville, Va.—Mica schist, per ton	10.00
Penland, N. C.—Mine scrap, per ton,	
10.00-17.00; clean shop scrap, 18.00;	
roofing mica, per ton	20.00
Franklin, N. C.	
Mine scrap, per ton	18.00
Clean shop scrap, per ton	20.00
Wet ground mica, per lb.	.03
Punch, per lb.	.05

Agricultural Limestone (Crushed)

Alco, Va.—Analysis, 97% CaCO ₃ ; 1% MgCO ₃ ; 50% thru 100 mesh, per ton	2.25
Alton, Ill.—Pulverized limestone	4.00
Branchton, Penn.—100% thru 20 mesh, 60% thru 100 mesh, 45% thru 200 mesh, all per ton	*4.50
Cartersville, Ga.—Pulverized limestone, per ton, 1.75; 50% thru 50 mesh, per ton	1.50
Chico, Tex.—Pulverized limestone, in 100-lb. bags, per cwt.	1.00
Colton, Calif.—Analysis, 95.97% CaCO ₃ ; 1.31% MgCO ₃ ; all thru 14 mesh down to powder	3.50
Davenport, Iowa—Analysis, 90-98% CaCO ₃ ; 2% and less MgCO ₃ ; 90% thru 4 mesh; bulk	1.00
Dolomite, Calif.—Analysis, 54% CaCO ₃ ; 45% MgCO ₃ ; 99% thru 10 mesh, per ton, 2.10; 49% thru 60 mesh, ¼-in. to dust, per ton	1.70
Dubuque, Ia.—Analysis, 64.04% CaCO ₃ ; 29.54% MgCO ₃ ; 50% thru 100 mesh, per ton	1.00
Fort Spring, W. Va.—Analysis, 90% CaCO ₃ ; 3% MgCO ₃ ; 50% thru 100 mesh, per ton, bulk, 1.50; in 80-lb. bags	2.75
Gibsonburg, Ohio—99% thru 10 mesh, 60% thru 100 mesh; in bags, per ton, 3.50; in bulk, per ton	2.50
Agricultural meal, 100% thru ¼-in. mesh screen, 25% thru 100 mesh screen, ton	1.00
Hillsville, Penn.—Ground agstone, in bulk, per ton, 1.35; pulverized limestone, per ton, bulk, 2.75; in bags	3.25
Lannon, Wis. 50% thru 100 mesh	1.50
Marion, Va.—Analysis, 80% CaCO ₃ ; 20% MgCO ₃ ; per ton	1.00
Marlbrook, Va.—Analysis, 95% CaCO ₃ ; 50% thru 100 mesh; per ton, in bulk, 2.25; in bags	3.25
McCook, Ill.—Analysis, 55% CaCO ₃ ; 45% MgCO ₃ ; 90% thru 50 mesh, 50% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh, all per ton	.60
Middlebury, Vt.—Analysis, 99.05% CaCO ₃ ; 90% thru 50 mesh	4.25
Osborne, Penn.—50% thru 100 mesh, per ton	2.50-4.00
Stone City, Ia.—Analysis, 98% CaCO ₃ ; 50% thru 50 mesh	.75
Waukesha, Wis.—90% thru 100 mesh, per ton, 4.00; 50% thru 100 mesh	2.10

Pulverized Limestone for Coal Operators

Davenport, Ia.—Analysis, 90-98% CaCO ₃ ; 2% and less MgCO ₃ ; 100% thru 20 mesh, 50% thru 200 mesh; sacks, ton	6.00
Joliet, Ill.—Analysis, 48% CaCO ₃ ; 42% MgCO ₃ ; 90% thru 200 mesh (bags extra)	3.50
Waukesha, Wis.—90% thru 100 mesh	4.00

Roofing Slag

Prices given are per ton f.o.b. city named.

Bethlehem, Penn.	1.00-1.50†
Buffalo, N. Y.	2.50†
Ensley and Birmingham, Ala.	2.05
Longdale, Va.	2.50
Toledo, Ohio	1.20†
Woodward, Ala.	2.05*

*Less 5c ton disc. for pay. 15th following month.

†Price f.o.b. trucks at plant, subject to discount of 10c per ton for payment on or before the 15th of following month. ‡F.o.b. plant. ¶F.o.b. trucks, slag plant.

Portland Cement

F.o.b. city named Per Bag	Per Bbl.	High Early Strength
Albuquerque, N. M. .66	2.64	
Atlanta, Ga.	1.90†	2.95†
Birmingham, Ala.	1.58†	2.63†
Boston, Mass. ....44½	1.78†	2.52†
Charleston, S. C.	1.93†	2.98†
Cheyenne, Wyo. ....52¼	2.09	
Chicago, Ill.	1.35†	2.00†
Cincinnati, Ohio	1.42†	2.07†
Cleveland, Ohio		2.08†
Columbus, Ohio		2.06†
Dallas, Tex.	1.81	2.86†
Dayton, Ohio		1.93†
Denver, Colo. ....50	2.00	
Detroit, Mich.	1.47†	2.12†
Houston, Tex.	2.03	3.08†
Indianapolis, Ind.	1.41†	2.06†
Jackson, Miss.	1.98†	3.03†
Jacksonville, Fla.	2.00†	3.05†
Kansas City, Mo. ....26	1.04†	
Los Angeles, Calif. ....57½	2.30	
Louisville, Ky.	1.45†	2.10†
Memphis, Tenn.	1.77†	2.82†
Milwaukee, Wis.	1.45†	2.04†
Montreal, Que.	1.66†	
New Orleans, La.	1.86†	2.96†
New York, N. Y. ....37¼	1.49†	2.28†
Oklahoma City, Okla. ....39½	1.58†	2.38†
Omaha, Neb. ....35	1.40†	2.30†
Portland, Ore.	2.40†	
Reno, Nev.	2.80†	
St. Louis, Mo.	1.37†	2.09†
San Francisco, Calif.	2.05†	
Savannah, Ga.	1.93†	2.98†
Seattle, Wash.	2.30-2.55	2.80c
Tampa, Fla.	2.00†	3.16†
Toledo, Ohio		2.02†
Topeka, Kan. ....31¼	1.25†	2.15†
Tulsa, Okla. ....37½	1.50†	2.40†

NOTE: Unless otherwise noted, prices quoted are net prices, without charge for bags. Add 40c per bbl. for bags. †Includes 10c cash disc. ‡Subject to 2% discount payment 10th of month following invoice date. §"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c discount 15 days. (c) Quick-hardening "Velo," packed in paper bags, 10c discount 10 days. §Sales tax included at 4%. *F.o.b. cars. ‡Trucks, mill.

Core and Foundry Sands

Silica sand quoted washed, dried, screened unless otherwise stated; lowest net prices per ton f.o.b. plant

City or shipping point	Fine	Coarse	Brass	Core	Furnace Sand	Stone
Albany, N. Y.	1.80	1.80	1.80		1.50c	
Columbus, Ohio	1.50	1.50			3.50	
Eau Claire, Wis.					2.50b	
Elco, Ill.	Amor. silica, 90-99½% thru 325 mesh,				\$10.00	
Montoursville, Penn.				1.35a		
New Lexington, Ohio	2.50	1.75				
Ohlton, Ohio	1.50	1.50		1.50	1.50	
Ottawa, Ill.					3.50	
Silica, Va.—Ground silica thru 140 mesh, 8.00.						
South Vineland, N. J.—Dry washed silica, 2.00 per ton.						
(a) To 1.60. (b) To 3.00. (c) To 3.50.						

Wholesale Prices of Slate

Lowest prices f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened, 200 mesh, 6.00 per ton in paper bags

Slate Granules

Pen Argyl, Penn.—Color, blue-grey, per ton..... 6.00*
*Bags, 50c each, returnable for credit.

Roofing Slate

City or shipping point	3/16-in.	¼-in.	⅜-in.	½-in.	¾-in.	1-in.
Bangor, Penn.—						
Genuine Bangor	8.25-9.50	14.00	20.00	24.00	35.00	45.00
Chapman Quarries, Penn.—						
Smooth texture	9.00-11.00					
Rugged	8.25- 9.00	a12.50	b18.00	b21.50	d25.00	e30.00
Pen Argyl, Penn.		9.60	13.80	16.20	22.20	27.00
Albion blue-grey roofing slate, No. 1 clear, 5.50-6.75; mediums, 5.50-6.25;						
No. 1 ribbon, 5.50-6.25; punching, all sizes, 35c per square.						
(a) To 15.00. (b) To 26.50. (d) To 32.00. (e) To 37.00.						

Prices are for standard preferred sizes (standard 3/16-in. slates), smaller sizes sell for lower prices. Prices other than 3/16-in. thickness include nail holes. Prices for punching nail holes, in standard thickness slates, vary from 50c to \$1.25 per square.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream and coral pink	\$12.50-14.50	\$12.50-14.50
Cardiff, Md.—Crushed green marble (a)	\$12.50-14.50	\$12.50-14.50
Cranberry Creek, N. Y.		\$12.00
Los Angeles, Calif.—(a)		
White	\$11.00-13.50	\$11.00-13.50
Snowflake		\$11.00-13.50
Golden, browns, grey, blues, blacks	\$16.00-18.50	\$16.00-18.50
Dolomite, Calif. (Lone Pine)—(a)		
White	\$8.80- 8.80	\$8.80- 8.80
Snowflake		\$8.80- 8.80
Golden, browns, grey, blues, blacks	\$13.80-13.80	\$13.80-13.80
Middlebrook, Mo.—Red		20.00- 25.00
Middlebury, Vt.—White		19.00-10.00
Randville, Mich.—Crystalline, crushed white marble, bulk	4.50	4.50- 5.00
Tuckahoe, N. Y.	5.00	
Warren, N. H., per ton		4.00- 5.00
†C.L. ‡L.C.L. *Per 100-lb. (a) Including bags.		

Art and Cast Stone Aggregates

Cardiff, Md.—Green marble fines in carloads; bulk, 7.50; in bags.....	10.00
Los Angeles, Calif.—Dolomite aggregates, all sizes and colors.....	\$10.00 \$12.50
Dolomite special cast stone, wet-cast aggregate, white, ¼-in. to dust a5.30	
† 100-lb. sacks. ‡C.L. ‡L.C.L. (a) In open cars.	

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Eau Claire, Wis. ....		.50-.75
Ohlton, Ohio	1.50	1.50

Glass Sand

(Silica sand is quoted washed, dried and screened)
Ohlton, Ohio 2.40
Ottawa, Ill. (Per ton, f.o.b. Ottawa).... 1.25
Silica, Va. 2.25-2.75
South Vineland, N. J. 1.50

Chicken Grits

Chico, Tex.—(Limestone) packed in 100-lb. sacks, per cwt., f.o.b. plant....	1.00
Cranberry Creek, N. Y.—Per ton.....	12.00
Davenport, Iowa—High calcium carbonate limestone, in bags, L.C.L., per ton	6.00
Gibsonburg, Ohio.—(Agstone) 5.00- 5.25	
Hannibal, Mo.—(Limestone), sacked, per ton	10.00
Hartford, Conn.—Per ton.....	1.80
Indianapolis, Ind.—Per ton.....	.40
Los Angeles, Calif.—Marble grits, per ton, incl. sacks.....	10.00-12.50
Maplewood, Mo.—(Limestone), per ton	10.00
Middlebury, Vt.—Per ton (a).....	10.00
New Braunfels, Tex.—(Limestone), per ton, in bulk.....	3.50
New York City—Per cu. yd.....	1.00
Port Clinton, Ohio.—(Gypsum), per ton	6.00
Salt Lake City, Utah—Per ton.....	.60
Utica, N. Y.—(Limestone), per ton.....	3.75
Warren, N. H.—(Aggregate).....	7.80-11.00
Waukesha, Wis.—(Limestone), per ton (a) F.o.b. Middlebury, Vt.	7.00

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chester, Vt.—Finely ground talc (carloads), Grade A—99.99½% thru 200 mesh, 7.50-8.00; Grade B, 97-98% thru 200 mesh.....	6.50- 7.00
1.00 per ton extra for 50-lb. paper bags; 166¼-lb. burlap bags, 15c each; 200-lb. burlap bags, 18c each. Credit for return of burlap bags. Terms 1%, 10 days.	
Emeryville, N. Y.:	
Crude ground talc (200 mesh), bags..	13.75
Crude ground talc (325 mesh), bags..	14.75
Henry, Va.:	
Crude mine run, per ton.....	3.50- 4.00
Ground talc (150-200 mesh), in bags..	4.80- 6.00
Joliet, Ill.:	
Ground talc, 200 mesh, in bags:	
California talc	30.00
Southern talc	20.00
Illinois talc	10.00
Los Angeles, Calif.:	
Ground talc (150-200 mesh) in bags..	15.00-30.00
Natural Bridge, N. Y.:	
Ground talc (325 mesh), in 50-lb., 100-lb. and 200-lb. bags, per ton.....	10.00-20.00

Lime Products

(Lowest carload prices per ton f.o.b. shipping point unless otherwise noted)

	Finish- ing hy- drate	Ma- son's hy- drate	Agricul- tural hy- cal hy- drate	Chem- ical hy- drate	Ground burnt lime, Bulk	Lump lime In bags	Lump lime In bbl.
EASTERN:							
Buffalo, N. Y.	5.50	4.75	4.75	10.50	5.50	7.50	6.00
Cedar Hollow, De- vauld, Rambo and Swedeland, Penn.		8.00c	8.00c	8.00c	7.00	8.00	8.00
Lime Ridge, Penn.			8.00		6.00	7.00	4.50
CENTRAL:							
Cold Springs, Ohio.....	4.75	4.75					5.00
Martin, Gibsonburg, Marblehead, Tiffin, Ohio, and Hunting- ton, Ind.	5.50	4.75	4.75	10.50	5.00	7.00	6.00†
Delaware, Ohio	5.50	4.75	4.75	6.00	5.00		5.00
Sheboygan, Wis.		10.50					8.50
Woodville, Ohio (x) ..	5.50	4.75	4.75	9.00	5.00	7.00	5.00
SOUTHERN:							
Eagle Mountain, Va.	8.00	8.00	8.00			8.00	6.50
Keystone, Ala.		7.50	6.50	7.50			6.50
Knoxville, Tenn.		7.50	7.50	7.50			5.00
Cartersville, Ga.		7.50	7.50			7.50	5.50

WESTERN:

Kirtland, N. Mex.							12.50d
Little Rock, Ark.	12.10				10.10		10.10
San Francisco, Cal.(b)18.50	16.00	11.00			18.50		
San Francisco, Calif.17.00	15.00	12.00	15.00	11.50			11.50

(a) In 100-lb. bags. (b) Woodburnt lime. (c) In 50-lb. paper. (d) To 15.00 †In 200-lb. steel barrels. ‡Refund for return of barrels. †To 17.50, plus bags as supplied. (x) Ohio Ritewall hair-fibred finishing lime, per ton, in 50-lb. paper bags, 9.00. ‡Also 5.00.

Stone-Tile Hollow Brick

Prices are net per thousand, f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	40.00	60.00	70.00
Altadena, Calif.	45.00	55.00	65.00
Asheville, N. C.	30.00	40.00	50.00
Atlanta, Ga.	29.00	42.50	53.00
Auburn, Wash.		50.00	65.00
Brownsville, Tex.		53.00	62.50
Brunswick, Me.	29.50	42.25	55.00
Chula Vista, Calif.		32.50	42.50
Daytona Beach, Fla.	45.00	55.00	65.00
Frostproof, Fla.	45.00	65.00	75.00
Houston, Tex.	36.00	53.00	66.00
Klamath Falls, Ore.	50.00	60.00	70.00
Longview, Wash.†		50.00	60.00
Los Angeles, Calif.	29.00	39.00	45.00
Macon, Ga.	25.00	35.00	45.00
Mattituck, N. Y.	45.00	55.00	65.00
Medford, Ore.	50.00	55.00	70.00
Memphis, Tenn.	45.00	50.00	60.00
Minneapolis, N. Y.	40.00	50.00	60.00
Nashville, Tenn.*	32.00	50.00	60.00
New Orleans, La.	45.00	55.00	65.00
Norfolk, Va.	33.00	46.00	60.00
Palm Springs, Calif.	45.00	60.00	70.00
Passaic, N. J.	42.50	55.00	75.00
Pasadena, R. I.	27.50	41.25	55.00
Presidio, Tex.	55.00	65.00	75.00
Roanoke, Va.	32.50	40.00	50.00
Salem, Mass.		40.00	60.00
San Antonio, Tex.	37.00	46.00	60.00
San Diego, Calif.	35.00	44.00	52.50
Spartanburg, S. C.	32.50	40.00	52.50

Prices are for standard sizes—No. 4, size 3½x4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size, 3½x8x12 in. *Delivered on job. †10% discount. ‡Stoneware, per 1000 at plant, 4x6x8, 55.00; 4x8x8, 64.00.

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point.

Camden, N. J.:		
8x8x16 in., each		.16a
Lexington, Ky.:		
8x8x16 in.		†18.00*
8x8x16 in.		†16.00*
Omaha, Neb. (Prices delivered):		
8x8x16 in., each	.12‡	.14‡
8x12x16 in., each	.16‡	.18‡
8x4x16 in., each	.07½‡	.09½‡
Wichita, Kan.:		
4x8x16 in., each		.07
*Price per 100 at plant. †Rock or panel face.		
‡Face. ††Plain. (a) Less 10%.		

Cement Drain Tile

Longview, Wash.—Price per foot.

3-in.	.05	6-in.	.10
4-in.	.06	8-in.	.15

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

	4-in.	6-in.	8-in.	10-in.	12-in.	15-in.	18-in.	20-in.	22-in.	24-in.	27-in.	30-in.	36-in.	42-in.	48-in.	54-in.	60-in.
Culvert and Sewer																	
Grand Rapids and Saginaw, Mich.																	
Sewer		.08½	.13½	.20	.25¾	.39¾	.62½	.75	1.00	1.12½	1.62½	1.80					
Culvert (b)				.55	.60	1.10	1.35	1.60e		1.80	2.00	2.25	3.10	4.00	5.50		
Longview, Wash.																	
Culvert		.30	.40		.55		1.10			1.50		2.70	4.25	5.00			
Newark, N. J.																	
Unreinforced	.08	.16	.26	.36	.46	.55	.90	1.10	1.26	1.50							
Reinforced					.90	1.05	1.40	1.60	1.75	2.05	2.60	3.00	4.00	5.00	6.00	8.50	12.00
Wahoo, Neb.					12-in., 15-in., 18-in., 24-in., and from 30-in. to 60-in. pipe, per ton, 10.00												
(a) Reinforced. (b) To contractors. (c) 21-in. pipe.																	

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

City or shipping point	Crushed Rock	Ground Gypsum	Agri-cultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	Plaster Board—36" Per 32x32x Lengths	Wallboard—36" Per 32x32x Lengths
East St. Louis, Ill.—3x18-in. partition sections cast up to 13 ft. in length, 10c surface ft.; 6x6-in. partition sections cast up to 10 ft. in length, 20c per surface ft.; 7x16-in. floor sections cast up to 13 ft. in length, 17c per surface ft.; precast fireproofing sections for ceilings, beams and columns are priced at 12c per surface ft.												
Los Angeles, Calif. (r)			8.02p		12.40q		13.40a					
Medicine Lodge, Kan.	1.40	6.00-8.00					11.50b		16.00b			
Port Clinton, Ohio	4.00	6.00-8.00	6.00-8.00	10.00m	10.00n	10.00n	20.00k	8.00-11.00	24.50f	26.00g	15.00h	15.00h
Winnipeg, Man.	5.00	5.00	7.00	14.00	15.00	15.00					20.00	25.00c
Woodville, Ohio									25.50b			33.00d

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) To 14.40 per ton. (b) Includes paper bags. (c) Includes jute sacks. (d) "Gyproc," 36x48-in. by 5 and 10 ft. long. (e) To 27.50. (f) To 29.00. (g) To 28.00. (h) To 16.00. (i) To 23.00. (j) To 12.00. (k) To 13.00. (l) To 9.02. (m) To 13.40 per ton. (n) Plaster board, 16x48—¾ in., per yd., 14½c; 16x48—¾ in., per yd., 16½c.

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Cicero, Ill.—French and Spanish tile, 9x15-in., per sq.	9.50-12.00
Closed end shingle, 8½x12½ in., per sq.	11.00-13.00
New York City, N. Y.—9x15 in., red, per sq., 10.00; green, per sq.	12.00

Rock Phosphate

Prices given are per ton (2240 lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Fernandina, Fla., B.P.L. 77/76%, per ton	6.50
Mt. Pleasant, Tenn.—B.P.L., 75%, per ton	6.25

Ground Rock

(2000 lb.)

Mt. Pleasant, Tenn.—(Lime phosphate) —B.P.L. 75%; per ton, bags extra	*12.80
—B.P.L. 65%, per ton	†6.00
Ground rock, B.P.L. 72%, per ton	5.00- 5.50
*85% thru 300 mesh.	
†50% thru 300 mesh.	

Florida Phosphate

(Raw Land Pebble)

Mulberry, Fla.—Gross ton, f.o.b. mines	
68/66% B.P.L.	3.15
70% minimum B.P.L.	3.75
72% minimum B.P.L.	4.25
75/74% B.P.L.	5.25
77/76% B.P.L.	6.25

Cement Building Tile

Lexington, Ky.:		
5x8x12, per 1000	55.00	
4x5x12, per 1000	35.00	
Wichita, Kan. (Duntile)	Plain	Glazed
8x8x12-in., each	.08	
6x8x12-in., each	.07	
6x6x12-in., each	.06	
4x5x12-in., each	.05	.08
4x4x12-in., each	.04	.07½

Concrete Brick

Prices given per 1000 brick, f.o.b. plant.

	Common	Face
Longview, Wash.	15.00	25.00- 60.00
Milwaukee, Wis.	12.50	16.00- 20.00
Omaha, Neb.	15.00	
Prairie du Chien, Wis.	12.00	20.00- 22.50
Wichita, Kan., per 1000	*8.00	*8.50
*8x8x16 size.		

Potash Feldspar

Redford Hills, N. Y.—Color, white; analysis, K ₂ O, 11%; Na ₂ O, 2.50%; SiO ₂ , 68%; Fe ₂ O ₃ , 0.06%; Al ₂ O ₃ , 18.25%; pulverized, 99% thru 20 mesh; per ton, in bags, 11.45; bulk..	10.25
Spruce Pine, N. C.—(Chemically controlled.) Color, white; 200 mesh; analysis, K ₂ O, 11.30%; Na ₂ O, 2%; SiO ₂ , 67%; Fe ₂ O ₃ , 0.10%; Al ₂ O ₃ , 18%; per ton, in bulk..	15.00
Spruce Pine, N. C.—Color, white; analysis, K ₂ O, 10%; Na ₂ O, 2.50%; SiO ₂ , 69%; Fe ₂ O ₃ , 0.08%; Al ₂ O ₃ , 17.75%; pulverized, 99% thru 20 mesh; in bags, per ton, 10.70; bulk..	9.50
Topsham, Me.—White; analysis, K ₂ O, 9.50%; Na ₂ O, 3.50%; SiO ₂ , 72%; Fe ₂ O ₃ , 0.09%; Al ₂ O ₃ , 16.75%; pulverized, 98% thru 200 mesh; per ton in bulk, 17.00; in bags..	18.20
Trenton, N. J.—White; analysis, SiO ₂ , 68%; Na ₂ O, 2.75%; K ₂ O, 10%; Fe ₂ O ₃ , 0.06%; Al ₂ O ₃ , 18%; pulverized, 99% thru 200 mesh; per ton, in bulk, 19.00; in bags, per ton..	20.20
West Paris, Me.—(Chemically controlled.) Color, white; 200 mesh; analysis, K ₂ O, 11.20%; Na ₂ O, 3.20%; SiO ₂ , 65.70%; Fe ₂ O ₃ , 0.09%; Al ₂ O ₃ , 19.20%; per ton, in bulk..	19.00

Soda Feldspar

Spruce Pine, N. C.—(Chemically controlled.) Color, white; 200 mesh; analysis, K ₂ O, 5.50%; Na ₂ O, 5.50%; SiO ₂ , 68.80%; Fe ₂ O ₃ , 0.10%; Al ₂ O ₃ , 18.60%; per ton, in bulk..	18.00
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Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points. Bags extra and returnable for full credit.

16- 30 mesh	20.00
30- 60 mesh	22.00
60-100 mesh	18.00
100 mesh and finer	9.00
Joliet, Ill.—All passing 100 mesh, f.o.b. Joliet, including cost of bags.	22.00

Whiting

St. Louis, Mo., per ton	15.00*
Chicago, Ill., prices per ton.	
Domestic putty whiting	10.00-12.00
Domestic precipitated whiting	15.00-20.00
Imported bolted whiting	30.00-35.00
Philadelphia, Penn.—English chalk whiting packed in 50-lb. paper bags, per ton, in carloads.	15.00
*Packed in bbl., f.o.b. St. Louis.	

Announce Plants for Nonmetallic Minerals Operation

THE Earth Products Co. of Houston, Tex., incorporated for \$300,000, has been granted a charter to mine, process and market nonmetallic minerals in Texas. The company has acquired mineral deposits comprising approximately 3000 acres located in various sections of the state.

The company has purchased land in the industrial section of Houston, Tex., convenient to the ship channel and with ample railroad facilities and plans have been completed for the erection of a 75 ft. by 300 ft. steel building.

The proposed plant will have the most modern equipment and will be divided into three parts. One division will be devoted to the preparation of bleaching earths, with a capacity of 300 tons of finished materials per day.

Another division will be devoted to the preparation of stucco, plaster, high-temperature refractories, asbestos, molding sand, silica flour, volcanic ash, talc, calcium carbonate, barite, kaolin and natural color sands and aggregates.

A third division will be known as the custom grinding division—and in addition to the processing of materials from its own properties the company will do custom grinding.

The officers and directors of the company are as follows: W. W. Rodgers, president, formerly vice-president of the Southland Ice Co., Dallas, Tex.; E. G. Noxon, vice-president and general manager, for many years engaged in the preparation and marketing of building materials and refractories; Walter Morgan, vice-president, for 20 years engaged in the preparation and sale of bleaching earths; Grace V. Noxon, secretary and treasurer.

Quarry Operation to Be Expanded

A. C. ROOT, founder of the Kaweah Quarries Co., and who has operated the agricultural lime plant on the Kaweah river east of Woodlake, Calif., for the last 16 years, has leased the grounds and plant to the Kaweah Quarries, Inc., a new company, for a period of 21 years.

The plant at present has an appraised value of \$80,000 and with the new additions this valuation will be increased to \$125,000.

The present equipment will be thoroughly overhauled, and a new primary crusher has been ordered. The plant with this addition will be capable of producing 1000 tons of crushed rock per day. The railroad trackage will be increased to care for 20 cars as soon as the new plant is installed.

The new company begins business with a contract for 30,000 tons of crushed rock.

A. C. Root is to retain the agricultural lime business and is adding machinery for mixing asphalt paving mixtures.—*Fresno (Calif.) Republican*.

John E. Weber

CAPT. John E. Weber, 65, widely known Spanish War veteran and business man, for 30 years secretary of the Casper E. Stolle Quarry and Construction Co., died February 13 at his home in East St. Louis, Ill., after a brief illness.

Captain Weber is survived by his widow and mother and by two sisters, Dr. Caroline Weber of Santa Rosa, Calif., and Mrs. Louise E. Frost of Springfield, Ill. Aside from being widely known in the construction and quarry industry, Captain Weber had an extensive acquaintance in the older generation of army men.



John E. Weber

At the conclusion of the Spanish War, Lieutenant Weber was assigned to the Philippine Islands, where he remained for about two years, reaching the rank of captain. Upon returning to the United States and civilian life he made a connection with the Casper Stolle Co., continuing without interruption until his death.

American Aggregates Corp. Expands

THE Million Sand and Gravel Co., in business in Cass county, Ind., for the past quarter of a century, recently was purchased by the American Aggregates Corp.

Floyd Million has been in poor health for some time and the sale was brought about due to his imminent retirement from business.

Frank Million has become affiliated with the American Aggregates Corp., it also was announced.

It is the aim of the American Aggregates Corporation to operate both its present plant on the Searight property and its newly acquired Million plant, it was stated.—*Logansport (Ind.) Tribune*.

Editor Praises S. L. Avery

THE FOLLOWING is quoted from an editorial, "Beating Depression," which recently appeared in the *Chicago (Ill.) Journal of Commerce*:

"Depression is no handicap for Sewell L. Avery. Through his able management of what might be called his father firm because he grew up with it—the United States Gypsum Co.—earnings in 1930 actually showed a slight advance over the boom times of 1929. Last year, however, earnings went the way of most, somewhat lower, as Mr. Avery said in commenting on the annual report: 'The drastic decline in the consumption of building products made 1931 a difficult year.' But, while all business has been slumping, Mr. Avery has made his greatest gains.

"In November he was made chairman of the board of Montgomery Ward and Co. to fill the place left vacant by Silas H. Strawn. A week ago he was elected to the board of Commonwealth Edison Co. and within 24 hours was named to a post on the executive committee. Now he has been elected president of Ward's, succeeding George B. Everitt. He is already a director of Armour and Co., the United States Steel Corp., Chicago and Great Western Railroad, Continental Chicago Corp., the Continental Illinois Bank, the Northern Trust and the State Bank and Trust of Evans-ton.

"Mr. Avery is not only an able man himself, but comes of a long line of able men who had much to do with the industrial development of Michigan. He began his career in the law, graduating in that profession at the University of Michigan in 1894. In the same year he started with The Alabaster Co., and came to the United States Gypsum Co. in 1901, becoming its president four years later. His force of character and business ability have made Gypsum a consistently sound company, even through hard times. This promises well for the future of Montgomery Ward."

To Distribute Cement Purchases

A NEW BUYING policy for the San Francisco, Calif., \$100,000,000 Hetch Hetchy water and power project was announced by Thomas A. Brooks, purchaser of supplies, recently.

Mr. Brooks said the new policy would make it possible to distribute the business among all local firms for the first time since 1928.

Rotating of purchases was adopted by Mr. Brooks when he discovered that since 1928 more than \$1,000,000 worth of cement used at Hetch Hetchy had been bought from one firm.

Mr. Brooks also said he would order competitive bids for all Hetch Hetchy supplies in the future.—*San Francisco (Calif.) News*.

Claim Illegal Sand Contracts in Nebraska

CHARGING CONSPIRACY and unlawful combination to establish a monopoly in sand and gravel used on highway in Nebraska, the attorney general, C. A. Sorensen, has filed a petition in equity in the state supreme court asking that a group of producers be held to be acting unlawfully and be restrained from continuing their present practices.

The petition alleges that more than \$1,500,000 has been spent in building up an unlawful combination and that more than 20 sand and gravel producers which formerly competed with each other now constitute an illegal combination in violation of the Nebraska anti-trust law.

It is charged that in addition to making agreements to prevent competitors from reaching railroad facilities, the combination has had secret understandings with railroad officials for the publishing of emergency rates on sand and gravel after the award of contracts based upon bids made in view of the freight rates then in effect.

Group Action in Silicosis Charge

THE OTTAWA Silica Co., an Ottawa, Ill., corporation, was made defendants in suits asking a total of \$525,000 damages which were filed in the circuit court by 11 former employees of the company recently.

Ten of the plaintiffs claim that they have contracted silicosis while working in the company's plant, and are seeking compensation of \$50,000 each for the disease and the other man is asking \$25,000 for an attack of arthritis and rheumatism he claims to have contracted while working in water at the plant.—*Peru (Ill.) Herald*.

Deny New Trial in Silicosis Case

JUDGE F. H. HAYES denied the Wedron Silica Co., Chicago, Ill., a new trial in the \$25,000 damage suit brought against it by Charles Clouse, a former employee of the company. A jury in the circuit court December 17 awarded Mr. Clouse damages of \$10,000 against the company for a case of silicosis he claims to have contracted while working in the company's plant at Wedron.—*Streator (Ill.) Times*.

Protest Opening of Quarry

COMPLAINT was made in the Springfield, Mo., council against the proposed location of a stone quarry by Harry Horton on Mount Vernon St., two property owners declaring such a project would greatly damage all the property in that vicinity.

The matter was left to W. G. Mackey, building inspector, to determine the zoning restrictions.—*Springfield (Mo.) Press*.

Midwest Agricultural Limestone Institute Functioning

THE FOLLOWING has been released officially by Wm. T. Kieffer, secretary of a new rock products promotional organization:

"The Midwest Agricultural Limestone Institute was organized December 1, 1931, to create a forum for the open discussion of problems confronting the agricultural limestone industry and to attempt their solution; to obtain and distribute educational matter of value to this industry; to collect and distribute statistics of value to this in-



W. R. Sanborn

dustry; to standardize and improve the quality of agricultural limestone and promote its greater use; and, to promote agriculture and soil improvement."

"In February, 1932, it was incorporated in Illinois under the law for the formation of corporations not for pecuniary profit. The 'Institute will attempt to serve a territory consisting of the State of Illinois and its surrounding or adjoining states.' For organization purposes this territory is divided into five districts: the Northern (or Chicago producing district), the Central (or Kankakee-Joliet producing district), the Southern (or East St. Louis-Southern Illinois producing district), the Western (or Iowa producing district), and the Eastern (or Indiana producing district).

"Any producer or distributor of agricultural limestone engaged in business within the territory served by the Institute may become a member upon payment of an initiation fee.

"At present the Institute has 28 members, divided as follows: Northern district, four

members; Central district, four members; Southern district, eight members; Western district, five members; Eastern district, seven members."

The officers of the Institute are: W. R. Sanborn, President (Lehigh Stone Co., Kankakee, Ill.); J. J. O'Laughlin, Vice-President (Consumers Co., Chicago, Ill.); E. B. Taylor, Treasurer (Midwest Rock Products Corp., Indianapolis, Ind.); W. T. Kieffer, Secretary, (Columbia Quarry Co., Saint Louis, Mo.). The board of directors comprises: O. P. Chamberlain, Dolese and Shepard Co., Chicago, Ill.; N. E. Kelb, Ohio and Indiana Stone Co., Greencastle, Ind.; E. J. Krause, Columbia Quarry Co., St. Louis, Mo.; P. M. Nauman, Dubuque Stone Products Co., Dubuque, Ia.; J. J. O'Laughlin, Consumers Co., Chicago, Ill.; W. R. Sanborn, Lehigh Stone Co., Kankakee, Ill.; C. C. Schmoeller, Mississippi Lime and Material Co., Alton, Ill.

Reorganization of South Carolina Fertilizer Company

UNDER AN ORDER filed with the clerk of court upon the petition of the receivers of the Merchants Fertilizer and Phosphate Co., a new company, to be known as the Merchants Fertilizer Co. and to be headed by Ashmead F. Pringle, will take over a large part of the materials and also lease the equipment of the former company and continue the manufacture of fertilizer. The plan was agreed to by all parties interested.

The petition as approved by the court provides for the use of the Charlotte plant for storage under an agreement with the Independent Chemical Co., to which was assigned the plants of the old company at Charleston and at Charlotte to satisfy claims of that organization.—*Charleston (S. C.) Post*.

Emergency Relief Quarry May Close

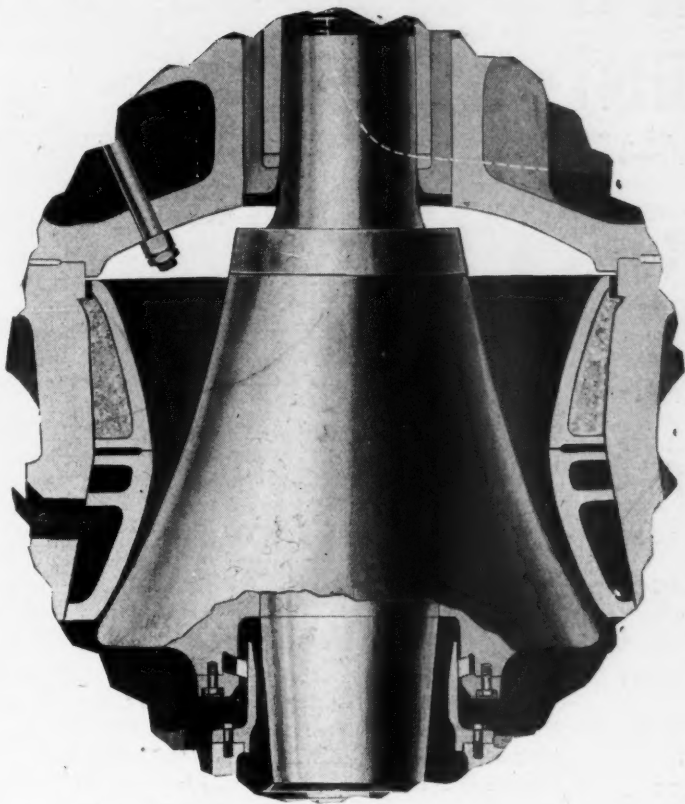
THE CITY-TOWNSHIP crusher plant at Pleasant Hill, Mo., under emergency operation and affording employment for jobless men and supplying crushed stone at \$1 per ton, may be shut down soon.

The plant will either be closed and the \$1-per-ton rock taken off the market, or one or two individuals who are negotiating for a lease will get control. In that event the price of rock would be increased, one of the lease applicants informed Mayor McGrady.—*Pleasant Hill (Mo.) Times*.

Roy E. Hammond

ROY E. HAMMOND, 54, secretary-treasurer of the Chicago Gravel Co., Chicago, Ill., died February 29 of pneumonia in his home at Elgin. He was prominent in Masonic affairs and was a trustee of Elgin academy. His widow, Mrs. Clara Read Hammond, and a son, David, survive.

ATTENTION, PLEASE!



TRAYLOR NON-CHOKING HEAD AND CONCAVES

Pat. Dec. 15, 1931
No. 1,837,102

In connection with certain types of non-choking crushers, we call the attention of the public to our patent 1,837,102 issued December 15, 1931 relating to crushers of this type. We intend to enforce our rights under said patent against all manufacturers and users of stone crushers containing the features covered by said patent and to prosecute all infringers of said patent.

TRAYLOR ENGINEERING & MANUFACTURING CO. ALLENTOWN, PENNSYLVANIA, U.S.A.

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30 Church St.

Chicago
1414 Fisher Bldg.

Los Angeles
908 Chester Williams Bldg.

Seattle
815 Alaska Bldg.

Salt Lake City
101 W. 2nd So. St.

Timmins, Ontario, Canada—Moore Block

March 26, 1932

Recognized the World Over as the Leader in Its Field

Rock Products

With which is
Incorporated

CEMENT and **ENGINEERING
NEWS**

Founded
1896

Entered as second-class matter, July 2, 1907, at the Chicago, Ill., postoffice under the Act of March 3, 1879. Copyrighted, 1932, by Trade Press Publishing Corporation

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TRADEPRESS PUBLISHING CORPORATION

542 South Dearborn Street, Chicago, Illinois, U. S. A.

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SUBSCRIPTION—Two dollars a year to United States and Possessions. \$4.25 a year to Canada (including duty) and to foreign countries. Twenty-five cents for single copies

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